Audit and Review Report for Plant Aging Management Reviews and Programs

Palisades Nuclear Plant
Docket No.: 50-255

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1.0 Introduction and General Information

1.1 Introduction

By letter dated March 22, 2005 (Agencywide Documents Access and Management System [ADAMS] Accession Number ML050940434), Nuclear Management Company (NMC, the applicant) submitted to the U.S. Nuclear Regulatory Commission (NRC) its application for renewal of Operating License DPR-20 for Palisades Nuclear Plant (PNP) (ML050940446). The applicant requested renewal of PNP's 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 PNP, the License Renewal and Environmental Impacts Program, Section B (RLEP-B), led a project team that audited and reviewed selected aging management reviews (AMRs) and associated aging management programs (AMPs) developed by the applicant to support the LRA for PNP. The project team included both NRC staff and contractor personnel provided by Information Systems Laboratories, Inc. (ISL), RLEB-B technical assistance contractor. Attachment 2 lists the project team members as well as other NRC staff and ISL personnel who supported the project team's review.

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

Details of how the project team implemented these requirements and guidance are found in "Audit and Review Plan for Plant Aging Management Reviews and Programs - Palisades Nuclear Plant," Docket No. 50-255 (ML051570082) (PNP 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 PNP for the period of extended operation.

This audit and review report documents the results of the project team's audit and review work. The project team performed its work at NRC Headquarters, Rockville, Maryland; at ISL's offices in Rockville, Maryland; and at the applicant's offices at the PNP plant site in Covert, Michigan. The project team conducted on-site visits during the weeks of June 20-24, 2005 and August 1-5, 2005. The project team held a public exit meeting in South Haven, Michigan on September 2, 2005. Attachment 2 lists the applicant's 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.

1.2 Background

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

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

The GALL Report is treated in the same manner as an 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 project team 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 project team will accept the applicant's reference to the GALL Report. In making this determination, the project team 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 project team 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 the 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 verifications and that those verifications are documented and retained by the applicant in an auditable form.

1.3 Summary of Information in the PNP License Renewal Application

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

1.3.1 PNP License Renewal Application Tables

PNP LRA Table 3.0-1 provides descriptions of internal and external service environments used in the AMRs to determine the aging effects requiring management. Results of the AMRs are presented in two table types.

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

X	Definition
1	Reactor Coolant System
2	Engineered Safety Features
3	Auxiliary Systems
4	Steam and Power Conversion System
5	Containments, Structures, and Component Supports
6	Electrical and Instrumentation and Controls

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

The applicant compared the PNP 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 correlate with the two table types described above.

1.3.1.1 Overview of PNP LRA Table 1

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

1.3.1.2 Overview of PNP LRA Table 2

PNP LRA Table 3.X.2-Y (Table 2) provides the detailed results of the AMRs for those components identified in PNP LRA Section 2 as being subject to an AMR. There is a Table 2 for each of the components or systems within a system grouping (e.g., reactor coolant system, engineered safety features, auxiliary systems, etc.). For example, the engineered safety features system group contains tables specific to the engineering safeguards 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 2.1-1 in Section 2 of the PNP 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.

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

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

(9) *Notes* - The ninth column contains notes that are used to describe the degree of consistency with the line-items in the GALL Report. Notes that use letter designations are standard notes based on the letter from A. Nelson, NEI, to P. T. Kuo, NRC, "U.S. Nuclear Industry's Proposed Standard License Renewal Application Format Package, Request NRC Concurrence," dated January 24, 2003 (ML030290201). (Note that the staff concurred in the format of the standardized format for LRAs by letter dated April 7, 2003, from P.T. Kuo, NRC, to A. Nelson, NEI [ML030990052]). Notes that use numeric designators are specific to PNP. The letter notes are described in detail in Section 3 of this audit and review report.

PNP LRA Table 2 contains the AMR results and indicates whether the results correspond to a line-item in Volume 2 of the GALL Report. Correlations between the combination in PNP LRA Table 2 and a combination for a line-item in Volume 2 of the GALL Report are identified by the GALL Report item number in Column 7. If Column 7 is blank, the applicant did not identify a corresponding combination in the GALL Report. If the applicant identified a GALL Report line-item, the next column provides a reference to a Table 1 row number. This reference corresponds to the GALL Report Volume 2 "roll-up" to the GALL Report Volume 1 tables. Many of the GALL Report evaluations refer to plant-specific programs. In these cases, the applicant considers the PNP evaluation to be consistent with the GALL Report if the other elements are consistent. Any AMP suitable for management of a particular aging effect is considered to be consistent with the GALL Report program for line-items referring to a plant-specific or alternative program if it has been reviewed and determined to be consistent with the program elements (attributes) used to review the plant-specific program (Note E).

1.4 Audit and Review Scope

The AMRs and associated AMPs that the project team reviewed are identified in the PNP audit and review plan. The project team examined 19 of the PNP AMPs and associated AMRs. The project team reviewed AMPs and AMRs that the applicant claimed were consistent with the GALL Report.

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 necessary to ensure consistency with GALL Report AMP recommendations or 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.

During the audit and review process, the project team determined that the applicant used the word “enhancement” to describe two types of revisions to plant procedures or program activities. The applicant used “enhancement” to describe programmatic revisions to existing PNP programs to achieve consistency with the GALL Report. The applicant also used the word “enhancement” to describe new procedures to be developed and implemented to institute an entirely new program. The project team reviewed both of these programmatic enhancements per the process described in the PNP audit and review plan.

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

1.5 Audit and Review Process

The project team performed the audit and review in accordance with the criteria defined in 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 PNP audit and review plan. This review process is summarized in this section.

1.5.1 PNP AMPs

For the PNP AMPs for which the applicant claimed consistency with the AMPs in the GALL Report, the project team determined consistency. The project team reviewed the PNP AMP descriptions and compared the program elements for those AMPs to the corresponding program elements for the GALL Report AMPs (Attachment 3 shows the 10 program elements from the SRP-LR). As discussed in the PNP audit and review plan, for program elements 7, "Corrective Action," 8, "Confirmation Process," or 9, "Administrative Controls," the NRR Division of Inspection Program Management (DIPM) reviewed and determined the adequacy of the applicant's 10 CFR 50, Appendix B Program and the results are documented in Section 3 of the safety evaluation report (SER) related to the PNP LRA.

For PNP 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 PNP 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 PNP 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 PNP AMPs that are not included in the GALL Report, the project team reviewed the PNP AMP against the program elements in the SRP-LR, Appendix A, for the program elements within its review scope. The project team determined whether these PNP AMPs would manage the aging effects for which they are credited.

1.5.2 PNP 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 AMR results reported by the applicant to be consistent with the GALL Report are consistent with the GALL Report. The project also determined that the plant-specific 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.

1.5.3 NRC-Approved Precedents

To help facilitate the project team's review of its LRA, an applicant may reference NRC-approved precedents to demonstrate that its non-GALL Report programs correspond to reviews that the NRC had 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 bounded 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 its documentation of its reviews of programs that are based on precedents, the precedent information is typically implicit in the evaluation rather than explicit. If the project team 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. As noted in Section 1.4 of this audit and review report, the applicant chose to provide precedent information to support its selection of certain PNP programs. Therefore, some of the project team reviews documented in this audit and review report considered precedent information in the manner described above.

1.5.4 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 Final Safety Analysis Review (FSAR) Supplement that summarizes the applicant's programs and activities for managing the effects of aging for the period of extended operation, as required by 10 CFR 54.21(d).

1.5.5 Documentation and Documents Reviewed

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

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

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

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

1.6 Exit Meeting

The project team held a public exit meeting with the applicant on September 2, 2005 to discuss the results of its audits and reviews of the AMP 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.

2.0 Aging Management Programs Audit and Review Results

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

2.1 <u>ALLOY 600 PROGRAM (PNP AMP B2.1.1)</u>

In PNP LRA, Appendix B, Section B2.1.1, the applicant states that PNP AMP B2.1.1, "Alloy 600 Program," is an existing plant program that is consistent with GALL AMP XI.M11, "Nickel-Alloy Nozzles and Penetrations."

2.1.1 <u>Program Description</u>

The applicant states, in the PNP LRA, that this program is an existing program that manages aging due to primary water stress corrosion cracking (PWSCC) of the primary coolant system (PCS) pressure boundary Alloy 600 components, including Inconel 82/182 weld joints, reactor vessel head penetrations, etc. The program includes (a) PWSCC susceptibility assessment using industry models to identify susceptible components, (b) monitoring and control of primary coolant chemistry to mitigate PWSCC, (c) in-service inspections (ISI) of pressurizer penetrations, reactor vessel head penetrations and Alloy 82/182 PCS pressure boundary welds in accordance with ASME Section XI, Subsection IWB, Table IWB-2500-1, and (d) augmented inspections or preemptive repair/replacement of susceptible components or welds.

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

In the PNP LRA, the applicant states that PNP AMP B2.1.1 is consistent with GALL AMP XI.M11.

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 PNP AMP B2.1.1, including basis document, LR-AMPBD-01, “Alloy 600 Program,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.M11.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B2.1.1 and associated basis documents against GALL AMP XI.M11 for consistency.

In the PNP LRA, the applicant states that PNP has Alloy 600 penetrations, all of which are contained within the primary coolant system (PCS). The project team asked for clarification of the Alloy 600 penetrations. In a letter dated August 25, 2005 (ML052410206), the applicant provides clarification concerning the nickel-alloy component locations. These nickel-alloy component locations are within the scope of its Alloy 600 Program, and include the following:

- 45 reactor vessel upper head control rod drive penetration nozzles
- 8 reactor vessel upper head incore Instrument penetration nozzles
- 1 reactor vent line penetration nozzle
- 2 reactor flange leak detector taps
- 1 pressurizer PORV nozzle safe end weld
- 1 pressurizer spray nozzle safe end
- 1 pressurizer surge line nozzle safe end
- 3 pressurizer safety and relief valve nozzle flanges
- 8 pressurizer level nozzles
- 2 pressurizer temperature element nozzle penetrations
- 128 pressurizer heater sleeves
- 4 primary coolant piping safety injection and shutdown cooling inlet nozzles safe ends
- 1 primary coolant piping shutdown cooling outlet nozzle safe end
- 1 primary coolant piping surge line nozzle safe end
- 22 temperature measurement nozzles
- 1 hot leg drain nozzle
- 4 cold leg drain nozzles
- 18 pressure measurement and sampling nozzles
- 2 primary coolant piping spray nozzles
- 2 primary coolant piping charging inlet nozzles
- 4 steam generator primary bowl plugs

In the PNP LRA, the applicant states that inspections are based on the requirements prescribed by the revised NRC Order EA-03-009 and Bulletin 2004-01.

The project team reviewed the applicant’s response to the revised NRC Order EA-03-009 and determined that RPV head aging management following the revised NRC Order EA-03-009 is acceptable.

The project team noted that Bulletin 2004-01 addresses inspection of alloy for pressurizer penetrations and steam space connections. The project team asked the applicant how other PWSCC locations are addressed. In its response to Bulletin 2004-01, the applicant indicated that it inspects all PCS nickel-alloy components. The project team reviewed the applicant’s response to Bulletin 2004-01 and found the response does apply to all PCS components.

The project team also noted that the Bulletin 2004-01 inspection commitments, for all nickel-alloy primary system pressure boundary locations normally operated at greater than or equal to 350°F, is for the next two refueling outages only. Therefore, the project team determined that inspection commitments prescribed by the applicant's response to Bulletin 2004-01 do not provide adequate aging management.

In a letter dated September 2, 2005, the applicant states that it will update its Alloy 600 Program to reflect the latest regulatory requirements and plant commitments at the time of submittal. The revised Alloy 600 Program description will be submitted for NRC review and approval by March 24, 2008.

The project team reviewed those portions of the PNP Alloy 600 Program for which the applicant claims consistency with GALL AMP XI.M11 and finds that they are consistent with the GALL Report AMP. Furthermore, the project team accepts the applicant's commitment to submit a revised Alloy 600 Program for NRC review and approval by March 24, 2008.

2.1.3 Exceptions to the GALL Report

None

2.1.4 Enhancements

None

2.1.5 Operating Experience

The applicant states, in the PNP LRA, that a review of the plant-specific operating experience revealed four instances where its Alloy 600 Program has been instrumental in discovering material degradation. Degradation was discovered in the following items:

- Pressurizer temperature element penetration
- Pressurizer safe end
- Control rod drive (CRD) nozzle penetration indications (2)

The project team reviewed industry operating experience, which included Bulletins 2001-01, 2002-01, 2002-02, and 2004-01, and the applicant's response to these Bulletins. The project team also reviewed the applicant's response to the revised NRC Order EA-03-009. The project team found that the applicant's inspection and responses to regulatory recommendations/requirements do provide timely detection of degradation for nickel-alloy components.

The project team reviewed the operating experience provided in the PNP LRA and basis documents, and interviewed the applicant's technical staff and confirmed that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

The project team reviewed those portions of the PNP Alloy 600 Program for which the applicant claims consistency with GALL AMP XI.M11 and finds that they are consistent with the GALL Report AMP. Furthermore, the project team accepts the applicant's commitment to submit a revised Alloy 600 Program for NRC review and approval by March 24, 2008.

2.1.6 FSAR Supplement

The applicant provides its FSAR Supplement for the Alloy 600 Program in PNP LRA, Appendix A, Section A2.1, which states that the Alloy 600 Program manages aging due to PWSCC of the primary coolant system (PCS) pressure boundary Alloy 600 components, including Inconel 82/182 weld joints, reactor vessel head penetrations, etc. The program includes (a) PWSCC susceptibility assessment using industry models to identify susceptible components, (b) monitoring and control of primary coolant chemistry to mitigate PWSCC, (c) in-service inspections (ISI) of pressurizer penetrations, reactor vessel head penetrations and Alloy 82/182 PCS pressure boundary welds in accordance with ASME Section XI, Subsection IWB, Table IWB-2500-1, and (d) augmented inspections or preemptive repair/replacement of susceptible components or welds.

During its audit and review, the project team noted that the program not only provides aging management for Alloy 600/182/82 components, but also provides aging management for Alloy 690/152/52/132 components as indicated in the applicant's basis documents. In a letter dated August 25, 2005, the applicant states that the program will manage nickel-alloy components instead of Alloy 600/182/82 components only. The project team finds this acceptable.

The project team reviewed the FSAR Supplement for PNP AMP B2.1.1, 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).

2.1.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. Furthermore, the project team reviewed those portions of the PNP Alloy 600 Program for which the applicant claims consistency with GALL AMP XI.M11 and finds that they are consistent with the GALL Report AMP. Furthermore, the project team accepts the applicant's commitment to submit a revised Alloy 600 Program for NRC review and approval by March 24, 2008.

On the basis of its review of the FSAR Supplement for this program, the project team finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

2.2 ASME SECTION XI IWB, IWC, IWD, IWF INSERVICE INSPECTION PROGRAM (PNP AMP B2.1.2)

In PNP LRA, Appendix B, Section B2.1.2, the applicant states that PNP AMP B2.1.2, "ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program," is an existing plant program that is consistent with GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," GALL AMP XI.M3, "Reactor Head Closure Studs," and GALL AMP XI.S3, "ASME Section XI, Subsection IWF."

2.2.1 Program Description

The applicant states, in the PNP LRA, that this program is an existing program that facilitates inspections to identify and correct degradation in Class 1, 2, and 3 piping, components, their supports and integral attachments. The program includes periodic visual, surface and/or volumetric examinations and leakage tests of all Class 1, 2, and 3 pressure-retaining components, their supports and integral attachments, including welds, pump casings, valve bodies, pressure-retaining bolting, piping/component supports, and reactor head closure studs. These are identified in ASME Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components,” or as commitments requiring augmented inservice inspections, and are within the scope of license renewal. This program is in accordance with 10 CFR 50.55a.

The applicant also states, in the PNP LRA, that 10 CFR 50.55a requires that inservice inspection (ISI) of Class 1, 2, and 3 pressure retaining components, their integral attachments and supports be conducted in accordance with the latest edition of ASME Section XI approved by the NRC twelve months prior to the start of a ten-year interval. The ISI Program for PNP’s third ten year interval, which began on May 12, 1995, implements ASME Section XI in accordance with applicable provisions and requirements of 10 CFR 50.55a. The IWB-2500 Category B-Q requirements to perform volumetric examinations of steam generator tubes is addressed by the Steam Generator Tube Integrity Program.

Class 1, 2, and 3 Component Supports

The applicant states, in the PNP LRA, that the examination scope provided by Table 2500-1 of Code Case N491-2 specifies the percentage of supports that must be examined. As specified by Table 2500-1, VT-3 examinations are conducted to determine the general mechanical and structural condition of components and their supports by verifying parameters such as clearances, settings, and physical displacement, and to detect discontinuities and imperfections, such as loss of integrity of bolted or welded connections, loose or missing parts, debris, corrosion, wear, or erosion. Acceptance standards for supports are given by Code Case N491-2.

Unacceptable conditions include:

- Deformation or structural degradation of fasteners, springs, clamps, or other support items;
- Missing, detached, or loosened support items;
- Arc strikes, weld spatter, paint, scoring, roughness, or general corrosion on close tolerance machined or sliding surfaces;
- Improper hot or cold positions of spring supports and constant load supports;
- Misalignment of supports; and
- Improper clearances of guides and stops.

Class 1, 2, and 3 Pressure-Retaining Bolting

The applicant also states, in the PNP LRA, that nondestructive examination, repair and replacement of pressure retaining bolting are conducted as part of its ISI Program. Examination requirements are in accordance with ASME Section XI, Table IWB-2500-1 or IWC-2500-1.

When Class 1, 2, and 3 bolting must be replaced as a result of degradation, ASME Section XI requirements for preservice examination are performed.

Reactor Vessel Head Closure Studs

In addition, the applicant states, in the PNP LRA, that reactor vessel head closure studs are examined as required by Table IWB-2500-1, examination category B-G-1, “Pressure Retaining Bolting Greater than 2 inches in Diameter.” Volumetric examinations are performed using Performance Demonstration Initiative (PDI) techniques in accordance with ASME Section XI, Appendix VIII and 10 CFR 50.55a. Lubrication of the studs is controlled via maintenance procedures.

2.2.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B2.1.2 is consistent with GALL AMP XI.M1, GALL AMP XI.M3, and GALL AMP XI.S3.

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 PNP AMP B2.1.2, including basis document, LR-AMPBD-02-ASMEISI, “ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.M1, GALL AMP XI.M3, and GALL AMP XI.S3.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B2.1.2 and associated basis documents against GALL AMP XI.M1, GALL AMP XI.M3, and GALL AMP XI.S3 for consistency.

The project team’s review of PNP LRA Section B2.1.2 identified an area in which additional information was necessary to complete the review of the applicant’s AMP. The applicant responded to the project team’s RAI as discussed below.

RAI-B2.1.2-1. Please define the ASME Code Edition for Inservice Inspection (ISI) Program B2.1.2.

In its response, dated July 1, 2005, the applicant states that during the AMP audit conducted June 20-23, 2005, a similar question was asked by the audit team. An extensive discussion ensued about which version of the ASME Section Xl code could be used as the basis of the license renewal AMP that is reviewed by the NRC, and what impacts an ASME code update under 10 CFR 50.55a, and the existing NRC-approved Risk-Informed Inservice Inspection Program, would have on the review. Possible options, including decoupling the Inservice Inspection Program under 10 CFR 50.55a from the license renewal AMP under 10 CFR 54, were reviewed. The audit question was left open, and additional management discussions are planned.

Therefore, the applicant also states, that the specific answer to this RAI question will not necessarily define the version of the ASME Code that NRC should review as the PNP AMP. A final response to that question must be deferred until after additional discussions with the NRC staff.

The applicant states that the specific information requested for RAI-B2.1.2-1 is as follows:

The Code of Federal Regulations, 10 CFR 50.55a, requires that inservice inspection of Class 1, 2, and 3 pressure retaining components, their integral attachments and supports, be conducted in accordance with the latest edition of ASME Section XI approved by the NRC 12 months prior to the start of a ten-year interval. The PNP Inservice Inspection Program for the current (third) ten-year interval, which began on May 12, 1995, implements the 1989 Edition, no addenda, of ASME Section Xl as modified by 10 CFR 50.55a and approved relief requests and code cases. One of the NRC-approved relief requests authorizes implementation of a Risk-Informed Inservice Inspection Program. This program will be in effect until the end of the current ten-year interval, which ends December 12, 2006.

Furthermore, in its response to RAI-B2.1.2-1, the applicant states that in 2006 it expects to update the inservice inspection code edition and addenda to those required for the fourth ten-year interval. It is anticipated that the Section Xl version which will be incorporated into the PNP program will be the 2001 Edition through the 2003 Addendum. This edition and addendum are the latest currently incorporated by reference in 10 CFR 50.55a(b).

During the audit and review, the project team asked a more general question related to the ASME code versions referenced by the applicant in its AMPs. This question is being tracked by the project team as OI-2.2.2-1. Based on this open item, the project team finds that RAI-B2.1.2-1 is closed.

In a letter dated August 25, 2005, the applicant states that it will revise its ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program descriptions in PNP LRA Appendices A and B to reflect that the applicant uses the 2001 Edition including the 2002 and 2003 Addenda of ASME Section XI. The revised program descriptions will identify exceptions to this code taken by the applicant, if any, that impact aging management effectiveness. Appropriate justification will also be provided to show that the exceptions, if any, still provide an acceptable level of aging management. The revised program descriptions will be submitted for NRC review and approval by October 31, 2005. **[This is Open Item OI-2.2.2-1.]**

During the audit and review, the project team noted that the basis document for this program is not consistent with the PNP LRA. Specifically, the basis document states that risk informed-inservice inspection (RI-ISI) alternative requirements apply to ASME Section XI Categories B-F, B-J, C-F-1 and C-F-2, as well as non-class welds. The PNP LRA does not address this item as an exception. The applicant states that it will provide justification why this item is not an exception.

GALL AMP XI.M1 does not recognize RI-ISI programs as an alternative to the current ASME Section XI inservice inspection requirement. PNP implemented a Risk Informed Program for Class 1, 2, 3 and non-class piping and obtained NRC approval of the relief request to use Risk-Informed ISI by letter dated May 19, 2003. While the number of the examinations is reduced, the risk from implementation of RI-ISI is expected to slightly decrease when compared to that estimated from the current requirements. The primary basis for the risk reduction is that examinations will be required for safety significant piping segments, which may not be currently inspected per the existing ASME Section XI Program. In addition, the RI-ISI Program is a living program that requires updating and expansion based on industry and site specific inspection findings. However, the applicant will have to request approval to use the RI-ISI Program for the specific intervals during the period of extended operation in accordance with 10 CFR 50.55a twelve months prior to each interval. Therefore, the project team finds that ASME Section XI, as referenced in 10 CFR 50.55a, twelve months prior to each inspection interval of extended operation, as modified by a NRC approved or authorized RI-ISI Program, is acceptable for the period of extended operation.

In its basis document, the applicant states that its reactor vessel closure studs have a minimum tensile strength of 145 ksi, which is well below 170 ksi specified in GALL AMP XI.M3. The project team noted that 170 ksi specified in the GALL Report is the actual strength instead of the minimum strength identified in the design specification. The applicant states that in 1977, the plant purchased thirty (30) replacement reactor closure studs, nuts and washers and the material for the studs was the same as furnished under the original contract. Section 4.2, "Mechanical properties" of the specification for the replacement studs, PN-76-104, "Replacement of Reactor Closure Studs, Nuts, Washers," states that "as described in Regulatory Guide 1.65, the post tempered maximum tensile strength shall not exceed 170 ksi." The project team found that the material properties are controlled by the specification to be less than 170 ksi and the material test reports filed with the purchase order demonstrate material properties less than 170 ksi. On this basis, the project team concludes that this is acceptable.

The project team reviewed those portions of PNP's ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program for which the applicant claims consistency with GALL AMP XI.M1, GALL AMP XI.M3, and GALL AMP XI.S3 and finds that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program provides reasonable assurance that scope for the RI-ISI not only considers the risk significance and failure probability, but also considers operating experience and that this program will reduce the risk and failure probability. The project team finds that, **predicated on satisfactory resolution of OI-2.2.2-1**, the applicant's ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program is acceptable because it conforms to the recommended GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," GALL AMP XI.M3, "Reactor Head Closure Studs," and GALL AMP XI.S3, "ASME Section XI, Subsection IWF."

2.2.3 Exceptions to the GALL Report

None

2.2.4 Enhancements

None

2.2.5 Operating Experience

The applicant states, in the PNP LRA, that PNP has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events and assesses these for applicability to its own operations. In addition, the PNP Corrective Action Program (CAP) is used to track, trend and evaluate plant issues/events. Those issues and events, whether external or plant-specific, that are potentially significant to the ASME Section XI ISI Program at PNP are evaluated. The ASME Section XI ISI Program is augmented, as appropriate, if these evaluations show that program changes will enhance program effectiveness.

The applicant states, in the PNP LRA, that using the OEP and CAP to focus on industry and plant operating experience ensures that ASME Section XI ISI Program issues are addressed in a timely manner and that age-related deterioration of SSCs within the scope of the ASME Section XI ISI Program will be effectively managed throughout the license renewal period.

The applicant also states, in the PNP LRA, that a review of the industry operating experience related to the ASME Section XI, Inservice Inspection aging management program revealed numerous instances where degradation of components, component supports, and bolting has occurred. In completing its review, the applicant looked at related issues which included stress corrosion cracking (SCC) and crack initiation and growth due to thermal loading.

The applicant states, in the PNP LRA, that a review of the plant-specific operating experience revealed 13 instances where the ISI Program has been instrumental in discovering degradation. Degradation was discovered in the following items:

- Control rod drive housings
- Piping welds
- Component supports
- Bolting
- Temperature element penetration
- Reactor coolant pressurizer safe end
- Engineered safeguards systems check valve

Furthermore, the applicant states, in the PNP LRA, that the PNP ISI aging management program has demonstrated on several occasions that it provides reasonable assurance that aging effects are being adequately managed for Class 1, 2, and 3 components, component supports, and bolting. This has been demonstrated through NRC inspection reports, INPO evaluations, audits, self-assessments, and the Corrective Action Program.
The project team reviewed the operating experience provided in the PNP LRA, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical staff, the project team concludes that, **predicated on satisfactory resolution of OI-2.2.2-1**, the applicant’s ASME Section XI, Subsections IWB, IWC, IWD, IWF Inservice Inspection Program will adequately manage the aging effects that are identified in the PNP LRA for which this AMP is credited.

2.2.6 FSAR Supplement

The applicant provides its FSAR Supplement for the ASME Section XI, Subsections IWB, IWC, IWD, IWF Inservice Inspection Program in PNP LRA, Appendix A, Section A2.2, which states that the ASME Section XI, Subsections IWB, IWC, IWD, IWF Inservice Inspection Program facilitates inspections to identify and correct degradation in Class 1, 2, and 3 piping, components, their supports and integral attachments. The program includes periodic visual, surface and/or volumetric examinations and leakage tests of all Class 1, 2, and 3 pressure-retaining components, their supports and integral attachments, including welds, pump casings, valve bodies, pressure-retaining bolting, piping/component supports, and reactor head closure studs. These are identified in ASME Section XI, “Rules for Inservice Inspection of

Nuclear Power Plant Components," or commitments requiring augmented inservice inspections, and are within the scope of license renewal. This program is in accordance with 10 CFR 50.55a.

The project team reviewed the FSAR Supplement for PNP AMP B2.1.2, 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).

2.2.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. The project team finds that, **predicated on satisfactory resolution of OI-2.2.2-1**, 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 FSAR Supplement for this program, the project team finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

2.3 BURIED SERVICES CORROSION MONITORING PROGRAM (PNP AMP B2.1.5)

In PNP LRA, Appendix B, Section B2.1.5, the applicant states that PNP AMP B2.1.5, "Buried Services Corrosion Monitoring Program," is a new plant program that is consistent with GALL AMP XI.M34, "Buried Piping and Tanks Inspection."

2.3.1 Program Description

The applicant states, in the PNP LRA, that this program is a new program that manages aging effects on the external surfaces of carbon steel, low-alloy steel, and stainless steel components that are buried in soil or sand. This program includes (a) visual inspections of external surfaces of buried components for evidence of coating damage and substrate degradation to manage the effects of aging, (b) visual inspection of the external surfaces of buried stainless steel components for evidence of crevice corrosion, pitting, and microbiologically influenced corrosion (MIC). The periodicity of these inspections for carbon, low-alloy, and stainless steel will be based on opportunities for inspection such as scheduled maintenance work.

The applicant also states, in the PNP LRA, that age-related degradation of buried components susceptible to selective leaching is managed by PNP AMP B2.1.13, "One-Time Inspection Program."

2.3.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B2.1.5 is consistent with GALL AMP XI.M34.

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 PNP AMP B2.1.5, including basis document, LR-AMPBD-05-BURIEDSVC, “Buried Services Corrosion Monitoring Program,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.M34.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B2.1.5 and associated basis documents against GALL AMP XI.M34 for consistency.

GALL AMP XI.M34 states that the program includes (a) preventive measures to mitigate corrosion, and (b) periodic inspection to manage the effects of corrosion on the pressure-retaining capacity of buried carbon steel piping and tanks. Preventive measures are in accordance with standard industry practice for maintaining external coatings and wrappings. The applicant states that its Buried Services Corrosion Monitoring Program is a new program that manages aging effects on the external surfaces of carbon steel, low-alloy steel, and stainless steel components that are buried in soil or sand.

The project team noted that the applicant is using PNP AMP B2.1.5 to manage aging effects of buried stainless steel components. However, GALL AMP XI.M34 monitors and inspects coating and wrapping integrity of the external surfaces of buried carbon steel and tanks. Since buried stainless steel components are not coated, it was not clear from the information provided in the PNP LRA and the basis documents how PNP AMP B2.1.5 manages the aging effect of stainless components in soil. In a letter dated August 25, 2005, the applicant states that its Buried Services Corrosion Monitoring Program contains requirements to perform a visual inspection of external surfaces of buried stainless steel components, inspecting for evidence of MIC, crevice, and pitting corrosion. The applicant further states that this is not an exception to the GALL Report program. The project team found this acceptable, since the applicant’s Buried Services Corrosion Monitoring Program manages the stainless piping aging effects which is beyond what is recommended in GALL AMP XI.M34.

During the audit and review, the project team noted that in the program element, scope of program, of PNP AMP B2.1.5, the applicant states that PNP has not identified any buried tanks in sand or soil. The project team asked the applicant to clarify that the PNP tanks, specifically those shown on PNP scoping boundary drawing LR-C3, are above ground tanks and not in contact with soil/sand. The applicant responded that there is only one below grade tank at PNP within scope for license renewal. The diesel fuel oil storage tank is below grade but is contained in a vault and not exposed to an environment of soil. The diesel fuel oil storage tank is managed by PNP AMP B2.1.9, “Diesel Fuel Storage and Monitoring Program.” The project team finds this response acceptable.

PNP AMP B2.1.5 under the program description heading and AMP basis document Section 4.2 state that the periodicity of the inspections for carbon, low-alloy, and stainless steel will be based on opportunities for inspection such as scheduled maintenance work. Also in the program element, detection of aging effects, of PNP AMP B2.1.5 and the AMP basis document Section 5.4, the applicant states that visual inspections of buried carbon steel, low-alloy, and stainless steel components will be performed based on plant operating experience and when components are excavated for maintenance or any other reason. GALL AMP XI.M34, Detection of Aging Effects, states that because the inspection frequency is plant-specific and also depends on the plant operating experience, the applicant’s proposed inspection frequency is to be further evaluated for the period of extended operation. During the audit and review, the project team requested that the applicant identify the inspection frequency for the buried piping using its Buried Services Corrosion Monitoring Program. In a letter dated July 1, 2005 (ML051960390), the applicant states that it would perform inspections within ten years after entering the period of extended operation.

The project team's review of PNP LRA Section B2.1.5 identified an area in which additional information was necessary to complete the review of the applicant's AMP. The applicant responded to the project team's RAI as discussed below.

<u>RAI-B2.1.5-1</u>. Please identify the inspection frequency for the buried piping aging management program B2.1.5.

In its response, dated July 1, 2005, the applicant states that its PNP Buried Services Corrosion Monitoring Program includes inspection activities that are designed to detect degradation due to aging effects prior to loss of intended function. Visual inspections of a sample of buried carbon, low-alloy, and stainless steel components will be performed within ten years after entering the period of extended operation, unless opportunistic inspections have occurred within this ten-year period. Prior to the tenth year, the applicant will perform an evaluation of available data to determine if sufficient inspections have been performed to assess the condition of the components. If insufficient data exists, focused inspection(s) will be performed as needed.

In addition, to its response of RAI-B2.1.5-1, the applicant states that this is very similar to the position contained in the "Safety Evaluation Report related to the License Renewal of the Joseph M. Farley Nuclear Plant, Units 1 and 2," issued as NUREG-1825.

The applicant submitted a response to a project team question in a letter dated September 16, 2005 which modifies the applicant's response to RAI-B2.1.5-1. The response provided in the September 16, 2005 letter is provided below in this section. Based on the response provided in the September 16, 2005 letter, the project team finds that RAI-B2.1.5-1 is closed because the applicant has committed to performing visual inspections of a sample of buried carbon, low-alloy and stainless steel components within ten years prior to entering, and within ten years after entering, the period of extended operation.

During the audit and review, the project team noted that this commitment is not consistent with the level of inspection that the staff has determined is appropriate for managing this aging effect. The staff has determined that inspections performed to confirm that coating and wrapping are intact for steel components are an effective method to ensure that corrosion of external surfaces has not occurred and the intended function is maintained. For stainless steel components, visual inspections of the external surfaces is sufficient to assure that the intended function is maintained. Prior to entering the period of extended operation, the applicant is to verify that there is at least one opportunistic or focused inspection performed within the past ten years. Upon entering the period of extended operation, the applicant is to perform a focused inspection within ten years, unless an opportunistic inspection occurred within this ten-year period. Any credited inspection should be performed in areas with the highest likelihood of corrosion problems, and in areas with a history of corrosion problems.

In a letter dated September 16, 2005, the applicant revised the commitment in the July 1, 2005 letter to the following:

> Visual inspections of a sample of buried carbon, low-alloy, and stainless steel components will be performed within ten years prior to entering, and within ten years after entering, the period of extended operation. Prior to the tenth year of each period, NMC will perform an evaluation of available data to determine sufficient opportunistic inspections have been performed within that period to assess the condition of the components. If insufficient data exists, focused inspection(s) will be performed as needed.

Based on the above discussion, the project team finds the applicant’s response acceptable, since it is consistent with the frequency of inspections of the buried components that the NRC staff has determined is appropriate for managing this aging effect.

The project team reviewed those portions of the Buried Services Corrosion Monitoring Program for which the applicant claims consistency with GALL AMP XI.M34 and finds that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant’s Buried Services Corrosion Monitoring Program provides reasonable assurance that the program will manage aging effects on the external surfaces of carbon steel and stainless steel piping that are buried in soil or sand. The project team finds the applicant’s Buried Services Corrosion Monitoring Program acceptable because it conforms to the recommended GALL AMP XI.M34, “Buried Piping and Tanks Inspection” with the difference identified by the project team.

2.3.3 Exceptions to the GALL Report

None

2.3.4 Enhancements

The applicant states, in the PNP LRA, that its Buried Services Corrosion Monitoring Program will be developed and implemented. Features of the program will include development and implementation of procedures for inspection of selected buried SSCs for corrosion, pitting and MIC. The periodicity of these inspections will be based on opportunities for inspection such as scheduled excavation and maintenance work.

In addition, the applicant states that the element descriptions describe the program as it will exist after the program has been implemented. The program is scheduled to be implemented prior to the period of extended operation.

The project team finds this enhancement acceptable, since PNP committed to implement PNP AMP B2.1.5, “Buried Services Corrosion Monitoring Program,” to include procedures for inspection of the buried components of corrosion, pitting, and MIC. This is consistent with GALL AMP XI.M34, “Buried Piping and Tanks Inspection.”

2.3.5 Operating Experience

The applicant states, in the PNP LRA, that PNP has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events and assesses these for applicability to its own operations. In addition, the PNP Corrective Action Program (CAP) is used to track, trend and evaluate plant issues/events. Those issues and events, whether external or plant-specific, that are potentially significant to the Buried Services Corrosion Monitoring Program at PNP are evaluated. The Buried Services Corrosion Monitoring Program is augmented, as appropriate, if these evaluations show that program changes will enhance program effectiveness.

The applicant states, in the PNP LRA, that using the OEP and CAP to focus on industry and plant operating experience ensures that Buried Services Corrosion Monitoring Program issues are addressed in a timely manner and that age-related deterioration of SSCs within the scope of the Buried Services Corrosion Monitoring Program will be effectively managed throughout the license renewal period.

The applicant also states, in the PNP LRA, that a review of industry operating experience applicable to aging of buried services reveals issues related to diesel fuel line leakage from the absence of required coating leading to corrosion. None of the industry operating issues or instances reflect any new program issues attributed to exterior corrosion to buried services component materials.

In addition, the applicant states that a review of plant-specific operating experience related to the Buried Services Corrosion Monitoring Program and aging revealed that the following issues have been addressed:

- Through wall leak in buried steam line.
- Generic program deficiencies from internal engineering programs audit.
- See the Fire Protection Program for OE related to buried fire main ruptures.

Furthermore, the applicant states, in the PNP LRA, that none of the plant operating issues or instances resulted from normal aging, nor do they reflect significant program deficiencies.

The project team reviewed the operating experience provided in the PNP LRA, and interviewed the applicant’s technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

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

The project team concludes that the PNP 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.

2.3.6 FSAR Supplement

The applicant provides its FSAR Supplement for the Buried Services Corrosion Monitoring Program in PNP LRA, Appendix A, Section A2.5, which states that the Buried Services Corrosion Monitoring Program manages aging effects on the external surfaces of carbon steel, low-alloy steel, and stainless steel components that are buried in soil or sand. This program includes (a) visual inspections of external surfaces of buried components for evidence of coating damage and substrate degradation to manage the effects of aging, (b) visual inspection of the external surfaces of buried stainless steel components for evidence of crevice corrosion, pitting, and MIC. The periodicity of these inspections for carbon, low-alloy, and stainless steel will be based on opportunities for inspection such as scheduled maintenance work.

In a letter dated September 16, 2005, the applicant states the following:

> Visual inspections of a sample of buried carbon, low-alloy, and stainless steel components will be performed within ten years prior to entering, and within ten years after entering, the period of extended operation. Prior to the tenth year of each period, NMC will perform an evaluation of available data to determine sufficient opportunistic inspections have been performed within that period to assess the condition of the components. If insufficient data exists, focused inspection(s) will be performed as needed.

The project team found this response acceptable, since PNP committed to develop PNP AMP B2.1.5, "Buried Services Corrosion Monitoring Program," to include procedures for inspection of the buried components of corrosion, pitting, and MIC.

The commitment for the enhancement to develop PNP AMP B2.1.5 is contained in the applicant's March 22, 2005 letter to the NRC.

The project team reviewed the FSAR Supplement and enhancement commitment for PNP AMP B2.1.5, found that they are consistent with the GALL Report, and determined that the FSAR Supplement 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).

2.3.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. 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 AMP being consistent with the GALL Report AMP to which it was compared. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

2.4 CLOSED CYCLE COOLING WATER PROGRAM (PNP AMP B2.1.6)

In PNP LRA, Appendix B, Section B2.1.6, the applicant states that PNP AMP B2.1.6, "Closed Cycle Cooling Water Program," is an existing plant program that is consistent with GALL AMP XI.M21, "Closed-Cycle Cooling Water System," with exceptions.

2.4.1 Program Description

The applicant states, in the PNP LRA, that this program manages aging effects in closed cycle cooling water systems that are not subject to significant sources of contamination, in which water chemistry is controlled and heat is not directly rejected to the ultimate heat sink. The program includes (a) maintenance of system corrosion inhibitor concentrations to minimize degradation, and (b) periodic or one-time testing and inspections to assess SSC aging.

The applicant also states, in the PNP LRA, that the program scope includes activities to manage aging in the component cooling water system (CCS), emergency diesel generator (EDG) jacket cooling water (emergency power system), and shield cooling system (SCS).

In addition, the applicant states, in the PNP LRA, that the program is based on requirements delineated in Electric Power Research Institute (EPRI) TR-107396, "Closed Cooling Water Chemistry Guideline," and relies on mitigative measures to minimize corrosion through the addition of corrosion inhibitors and maintenance of water chemistry within specified limits.

Furthermore, the applicant states, in the PNP LRA, that the program credits PNP AMP B2.1.13, "One-Time Inspection Program," for the inspection of selected shield cooling system and emergency diesel generator system heat exchangers and a representative sample of stagnant portions of the system piping. The inspections will check for fouling and evidence of corrosion or cracking. Nondestructive examinations will be used, if practical and warranted, to verify pipe wall thickness at selected locations where loss of material has been experienced.

2.4.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B2.1.6 is consistent with GALL AMP XI.M21, 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 PNP AMP B2.1.6, including basis document, LR-AMPBD-06-CCCW, "Closed Cycle Cooling Water Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M21.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B2.1.6 and associated basis documents against GALL AMP XI.M21 for consistency.

During the audit and review, the applicant stated that the version of EPRI TR-107396 used for its Closed Cycle Cooling Water Program is Revision 1, which is not consistent with GALL AMP XI.M21. In a letter dated August 25, 2005, the applicant states that it will submit, for NRC review and approval, a comparison of TR-107396, Revision 1 with Revision 0 to identify the material changes that impact aging management and justify its acceptability by

October 31, 2005. If necessary, the submittal will include a Closed Cycle Cooling Water Program description, revised to identify and justify use of TR-107396, Revision 1, as an exception to the GALL AMP XI.M21 program description. **[This is Confirmatory Item CI-2.4.2-1.]**

The project team reviewed those portions of the Closed Cycle Cooling Water Program for which the applicant claims consistency with GALL AMP XI.M21 and finds that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's Closed Cycle Cooling Water Program provides reasonable assurance that the aging effects due to loss of material and fouling will be adequately managed through the use of corrosion inhibitors and the use of surveillance and testing to monitor the effects of corrosion on the intended function of the components in the system. The project team finds that, **predicated on satisfactory resolution of CI-2.4.2-1**, the applicant's Closed Cycle Cooling Water Program is acceptable because it conforms to the recommended GALL AMP XI.M21, "Closed-Cycle Cooling Water System," with exceptions as described below.

2.4.3 Exceptions to the GALL Report

The applicant states, in the PNP LRA, that the exception to the GALL Report elements is as follows:

Elements: 3: Parameters Monitored/Inspected
5: Monitoring and Trending
6: Acceptance Criteria
Exception: PNP does not credit active flow testing for managing age-related degradation of component cooling water components.

The GALL Report identifies the following recommendations for the "parameters monitored/inspected," "monitoring and trending," and "acceptance criteria" program elements associated with the first exception taken:

> For pumps, the parameters monitored include flow and discharge and suction pressures. For heat exchangers, the parameters monitored include flow, inlet and outlet temperatures, and differential pressure.

The applicant states, in the PNP LRA, that performance of selected heat exchangers is monitored in accordance with the plant Master Heat Exchanger Testing Plan. The performance and operability testing of selected pumps, including flow, suction and discharge pressure, is monitored in accordance with ASME Section XI, Subsection IWP, Inservice Testing Program. In addition, during the audit and review, the project team noted that PNP does perform the required system and component performance testing as part of existing plant programs. In a letter dated August 25, 2005, the applicant states that the PNP LRA is revised to address these elements and to remove this exception. These elements as revised are consistent with the GALL Report. On the basis that this change makes the AMP consistent with the GALL Report, the project team finds this response acceptable.

The applicant also states, in the PNP LRA, that the exception to the GALL Report elements is as follows:

Elements: 4: Detection of Aging Effects
5: Monitoring and Trending
6: Acceptance Criteria
Exception: PNP does not credit active performance and functional testing for managing age-related degradation of component cooling water components.

The GALL Report identifies the following recommendations for the "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements associated with the second exception taken:

> The extent and schedule of inspections and testing in accordance with EPRI TR-107396, assure detection of corrosion before the loss of intended function on the component. Performance and functional testing in accordance with EPRI TR-107396, ensures acceptable functional testing of the CCCW system or components serviced by the CCCW system.

The applicant states, in the PNP LRA that performance of selected heat exchangers is monitored in accordance with the Master Heat Exchanger Testing Plan. The performance and operability testing of selected pumps, including flow, suction and discharge pressure, is monitored in accordance with ASME Section XI, Subsection IWP, Inservice Testing Program. In addition, during the audit and review, the project team noted that PNP does perform the required system and component performance testing as part of existing plant programs. In a letter dated August 25, 2005, the applicant states that the PNP LRA is revised to address these elements and to remove this exception from the AMP. These elements as revised will be consistent with the GALL Report. The project team finds this response acceptable.

2.4.4 Enhancements

None

2.4.5 Operating Experience

The applicant states, in the PNP LRA, that PNP has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events and assesses them for applicability to its own operations. In addition, the PNP Corrective Action Program (CAP) is used to track, trend and evaluate plant issues/events. Those issues and events, whether external or plant-specific, that are potentially significant to the Closed Cycle Cooling Water Program at PNP are evaluated. The Closed Cycle Cooling Water Program is augmented, as appropriate, if these evaluations show that program changes are needed to enhance program effectiveness.

The applicant states, in the PNP LRA, that using the OEP and CAP to focus on industry and plant operating experience ensures that its Closed Cycle Cooling Water Program issues are addressed in a timely manner and that age-related deterioration of SSCs within the scope of its Closed Cycle Cooling Water Program will be effectively managed throughout the license renewal period.

The applicant states, in the PNP LRA, that a review of industry operating experience associated with its Closed Cycle Cooling Water Program and aging reveals issues and instances related to:

- SCC in reactor coolant pump oil cooler discharge piping
- Corroded solder connections in diesel lube oil cooler due to inadequate corrosion inhibitor
- Inoperable check valves (stuck open) due to corrosion product buildup
- Cracks in component cooling water piping
- Fouling of diesel cooling water heat exchangers

The applicant also states, in the PNP LRA, that various related NRC and/or industry generic communications have been issued, and, in turn, have been incorporated into the program as applicable.

In addition, the applicant states, in the PNP LRA that review of plant-specific operating experience related to its Closed Cycle Cooling Water Program and aging revealed that the following issues have been addressed:

- Tube blockage and fouling in component cooling heat exchanger
- Fuel Pool Heat Exchanger tube breakage due to high Component Cooling Water flow
- Through wall flaw in spent fuel pool cooling pipe

The applicant also states, in the PNP LRA, that the Closed Cycle Cooling Water Program has demonstrated that it provides reasonable assurance that aging effects are being managed for the applicable SSCs. Additionally, this has been demonstrated through NRC inspection reports, audits, self-assessments, and the Corrective Action Program.

The project team reviewed selected condition reports as well as a recent system health and status report for the component cooling system. The condition reports reviewed did not reveal any instances in which the intended function of any system components was lost. In addition, the applicant's "Health and Status Report for the Component Cooling System," dated June 23, 2005, indicated satisfactory system operation and no adverse chemistry trends. Based on a review of this information, the project team concluded that the applicant's Closed Cycle Cooling Water Program is effective in managing the aging effects before the loss of intended component function.

The project team reviewed the operating experience provided in the PNP LRA, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical staff, the project team concludes that, **predicated on satisfactory resolution of CI-2.4.2-1**, the applicant's Closed Cycle Cooling Water Program will adequately manage the aging effects that are identified in the PNP LRA for which this AMP is credited.

2.4.6 FSAR Supplement

The applicant provides its FSAR Supplement for the Closed Cycle Cooling Water Program in PNP LRA, Appendix A, Section A2.6, which states that the Closed Cycle Cooling Water Program manages aging effects in closed cycle cooling water systems that are not subject to significant sources of contamination, in which water chemistry is controlled and heat is not directly rejected to the ultimate heat sink. The program includes (a) maintenance of system corrosion inhibitor concentrations to minimize degradation, and (b) periodic or one-time testing and inspections to assess component aging. This program is based on the guidelines in EPRI TR-107396.

The project team reviewed the FSAR Supplement for PNP AMP B2.1.6, 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).

2.4.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team finds that those program elements for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. In the PNP LRA, the applicant identified two exceptions to the GALL Report AMP. In a letter dated August 25, 2005, the applicant revises the PNP LRA to address the program elements which were part of these two exceptions. With the removal of these two exceptions, the PNP AMP is consistent with the GALL Report. The project team finds that, **predicated on satisfactory resolution of CI-2.4.2-1**, 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).

On the basis of its review of the FSAR Supplement for this program, the project team also finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

2.5 CONTAINMENT INSERVICE INSPECTION PROGRAM (PNP AMP B2.1.7)

In PNP LRA, Appendix B, Section B2.1.7, the applicant states that PNP AMP B2.1.7, "Containment Inservice Inspection Program," is an existing plant program that is consistent with GALL AMP XI.S1, "ASME Section XI, Subsection IWE," GALL AMP XI.S2, "ASME Section XI, Subsection IWL," and GALL AMP X.S1, "Concrete Containment Tendon Prestress."

2.5.1 Program Description

The applicant states, in the PNP LRA, that this program is an existing program that is designed to ensure that containment shell concrete, the post-tensioning system and steel pressure retaining elements continue to provide an acceptable level of structural integrity. In addition, it is designed to ensure that the liner (with associated moisture barriers), other leakage limiting steel barriers and pressure retaining bolted connections have not degraded. This program does not demonstrate actual containment leak tightness; that is done under PNP AMP B2.1.8, "Containment Leakage Testing Program."

The applicant also states that this program incorporates elements of several applicable programs identified in the GALL Report. These are as follows:

- XI.S1 - ASME Section XI, Subsection IWE
- XI.S2 - ASME Section XI, Subsection IWL
- X.S1 - Concrete Containment Tendon Prestress

2.5.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B2.1.7 is consistent with GALL AMP XI.S1, GALL AMP XI.S2, and GALL AMP X.S1.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report for PNP AMP B2.1.7, including basis document, LR-AMPBD-08-CONTISI, "Containment Inservice Inspection Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.S1, GALL AMP XI.S2, and GALL AMP X.S1.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B2.1.7 and associated basis documents against GALL AMP XI.S1, GALL AMP XI.S2, and GALL AMP X.S1 for consistency.

GALL AMP XI.S1, "ASME Section XI, Subsection IWE" and GALL AMP XI.S2, "ASME Section XI, Subsection IWL" identify both the 1992 Edition with the 1992 Addenda and the 1995 Edition with the 1996 Addenda, as approved in 10 CFR 50.55a, as the applicable editions of the ASME code for these programs. In the PNP LRA, the applicant states that PNP AMP B2.1.7, "Containment Inservice Inspection Program," follows the ASME Section XI, 1998 Edition with no addenda. The project team asked the applicant to provide the documentation where the NRC approves the use of the 1998 Edition (no addenda) of the ASME code for IWE and IWL inspections.

In a letter dated August 25, 2005, the applicant states that the NRC approved the use of the 1998 Edition in a letter dated September 27, 2002, "Palisades Plant - Evaluation of Containment In-service Inspection Relief Requests (TAC Nos. MB4216 and MB4218)."

The applicant provided to the project team NRC Docketed letter, "Palisades Plant - Evaluation of Containment Inservice Inspection Relief Requests." The NRC cover letter states: The licensee (PNP) is seeking relief from the requirements of the 1992 Edition with the 1992 Addenda of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (the Code), Section XI, Subsections IWE and IWL. As an alternative, the licensee proposes to use the provisions of Subsections IWE and IWL of the 1998 Edition of the Code, which has not yet been incorporated by reference into 10 CFR 50.55a.

The final paragraph of the cover letter dated September 27, 2002 states: The licensee's proposed alternative to use the 1998 Edition of Subsections IWE and IWL, as supplemented by commitments in the licensee's February 21, 2002 letter, will provide an acceptable level of quality and safety for ensuring the integrity of the pressure boundary of the containment at PNP. Therefore, the proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(I). As requested, this relief is authorized for the balance of the current 10-year inspection interval.

During discussions with the applicant, the project team emphasized that although the applicant had received a relief request to use the 1998 Edition instead of the 1992 or 1995 Edition of the ASME code for IWE and IWL inspections, under license renewal, this inconsistency with GALL AMP XI.S1, “ASME Section XI, Subsection IWE,” and GALL AMP XI.S2, “ASME Section XI, Subsection IWL,” is an exception. After further discussions with the project team, the applicant agreed to change PNP AMP B2.1.7 to reflect the use of the 1998 ASME Code Edition instead of the GALL specified 1992 or 1995 Edition as an exception and provide written discussion on the code edition differences in ASME Section XI Subsections IWE and IWL.

In a letter dated August 25, 2005, the applicant states that the PNP Containment Inservice Inspection Program references the 1998 Edition, no addenda, for Section XI, Subsections IWE and IWL, except that the personnel qualification process is based on the 1992 Edition through 1992 Addendum. PNP will revise by another letter its Containment Inservice Inspection Program description in the PNP LRA to identify use of the 1998 Edition as an exception to the GALL Report. Exceptions taken to the 1998 Edition, if any, will be identified as part of the program description. A comparison of the 1998 Edition with the 1995 Edition/1996 Addendum referenced in the GALL Report, Revision 0, or the 2001 Edition, including the 2002 and 2003 Addenda, referenced in the GALL Report, draft Revision 1 (publicly released on August 12, 2005), will also be developed to support the adequacy of the 1998 Edition of IWE and IWL for aging management. **[This is Open Item OI-2.5.2-1.]**

GALL AMP XI.S2, ASME Section XI, Subsection IWL under program element 5, monitoring and trending, has the following statement: In addition to the random sampling used for tendon examination, one tendon of each type is selected from the first-year inspection sample and designated as a common tendon. Each common tendon is then examined during each inspection. The applicant makes the following statement in PNP AMP B2.1.7 under element 1, Scope of Program for Concrete Containment Tendon Prestress: During the scheduled surveillances, the tendon prestress force is measured for a random sample of each tendon group. One tendon in each group is designated as the common tendon.

During the audit and review, the project team asked the applicant to provide all the lift-off test results for the common tendon in each tendon group. The applicant stated that there was not really a common tendon for each group that went back to the first-year inspection sample. However, going forward with the current operating license and anticipated extended operating license, the applicant had designated and established a common tendon for each group during the last surveillance inspection. After further discussions with the project team, the applicant agreed to change PNP AMP B2.1.7 throughout where there is discussion of a common tendon to make it clear that a common tendon in each group has only recently been established and there are no common tendon test results from the first-year inspection sample forward. Since there are no historic common tendons as specified in the GALL Report, the applicant has designated the difference an exception to the GALL Report after revising the PNP LRA.

In a letter dated August 25, 2005, the applicant states that the PNP tendon surveillance program was directed by Plant Technical Specifications until 10 CFR 50.55a invoked testing in accordance with ASME Section XI, Subsection IWL in 1996. PNP Technical Specifications did not require the selection of common tendons. As a result, common tendons were not defined at PNP until the 30-year tendon surveillance conducted in 2002. The selected tendons did not meet the desired criteria in that they had been detensioned during the first tendon surveillance in the early 1970s. Therefore, PNP AMP B2.1.7, “Containment Inservice Inspection Program,” exceptions to the GALL Report, is hereby revised to read, "The generally accepted definition of common tendon does not completely correspond with GALL AMP XI.S2, 'ASME Section XI Subsection IWL' portion of the Containment Inservice Inspection Program, and is considered to be an exception to NUREG 1801."

In this letter, the applicant further states that this exception does not degrade the effectiveness of the program to assure an acceptable level of containment structural integrity at all times. The PNP Tendon Surveillance Program is designed to maintain the tendon force above minimum analysis requirements on a continuous basis from surveillance to surveillance. This is accomplished each surveillance by performing tendon force measurements, comparing the results against expected levels for tendon force, and assuring that any expected relaxation will not reduce tendon forces below minimum requirements beyond at least the next surveillance. Structural integrity does not rely solely on the projection of forces in a designated common tendon out to the end of plant life.

The project team finds the above response acceptable on the following basis. Although a historic common tendon does not exist, common tendons have been designated going forward for the remaining current operating license period and potential extended operating license period. The program is still effective since during each tendon surveillance, tendon force measurements are taken and compared against expected levels for tendon force. This assures that the expected tendon relaxation will not reduce the tendon forces below minimum requirements until the next surveillance.

The project team reviewed those portions of the applicant's Containment Inservice Inspection Program for which the applicant claims consistency with GALL AMP XI.S1, GALL AMP XI.S2, and GALL AMP X.S1 and finds that they are consistent with the GALL Report AMPs. Furthermore, the project team concludes that the applicant's Containment Inservice Inspection Program provides reasonable assurance that the aging management of conditions such as cracks, spalling, pop-outs, erosion and abrasion of concrete containment surfaces, corrosion of carbon steel components comprising the containment pressure boundaries, and degradation of containment pressure-retaining polymers will occur for the period of extended operation. The project team also concludes that the applicant's Containment Inservice Inspection Program provides reasonable assurance that proper assessment of the PNP containment tendon prestressing forces will occur for the period of extended operation. The project team finds that, **predicated on satisfactory resolution of OI-2.5.2-1**, the applicant's Containment Inservice Inspection Program is acceptable because it conforms to the recommended GALL AMP XI.S1, "ASME Section XI, Subsection IWE," GALL AMP XI.S2, "ASME Section XI, Subsection IWL," and GALL AMP X.S1, "Concrete Containment Tendon Prestress."

2.5.3 Exceptions to the GALL Report

Although not characterized as an exception to the GALL Report in the PNP LRA, the applicant identifies the following exception to the GALL Report in a letter dated August 25, 2005:

Program Description:	ASME Code of Record
Exception:	The PNP Containment Inservice Inspection Program references the ASME 1998 Code Edition, no addenda, for Section XI, Subsections IWE and IWL, except that the

personnel qualification process is based on the 1992 Edition through 1992 Addendum.

The GALL Report identifies the following recommendation for the "ASME Code of Record" in the program description associated with the exception taken:

GALL AMP XI.S1, "ASME Section XI, Subsection IWE":

10 CFR 50.55a imposes the inservice inspection (ISI) requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI, Subsection IWE for steel containments (Class MC) and steel liners for concrete containments (Class CC). The full scope of IWE includes steel containment shells and their integral attachments; steel liners for concrete containments and their integral attachments; containment hatches and airlocks; seals, gaskets and moisture barriers; and pressure-retaining bolting. This evaluation covers both the 1992 Edition with the 1992 Addenda and the 1995 Edition with the 1996 Addenda, as approved in 10 CFR 50.55a.

GALL AMP XI.S2, "ASME Section XI, Subsection IWL":

10 CFR 50.55a imposes the examination requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI, Subsection IWL for reinforced and prestressed concrete containments (Class CC). The scope of IWL includes reinforced concrete and unbonded post-tensioning systems. This evaluation covers both the 1992 Edition with the 1992 Addenda and the 1995 Edition with the 1996 Addenda, as approved in 10 CFR 50.55a. ASME Code Section XI, Subsection IWL and the additional requirements specified in 10 CFR 50.55a(b)(2) constitute an existing mandated program applicable to managing aging of containment reinforced concrete and unbonded post-tensioning systems for license renewal.

The applicant states in the letter that the PNP Containment Inservice Inspection Program references the 1998 Edition, no addenda, for Section XI, Subsections IWE and IWL, except that the personnel qualification process is based on the 1992 Edition through 1992 Addendum. PNP will revise by letter the Containment Inservice Inspection Program description in the PNP LRA to identify use of the 1998 Edition as an exception to the GALL Report. After revision by letter to the PNP LRA, exceptions taken to the 1998 Edition, if any, will be identified and justified as part of the program description. A comparison of the 1998 Edition with the 1995 Edition/1996 Addendum referenced in the GALL Report, Revision 0, or the 2001 Edition, including the 2002 and 2003 Addenda, referenced in the GALL Report, draft Revision 1 (publicly released on August 12, 2005), will also be developed to support the adequacy of the 1998 Edition of IWE and IWL for aging management. The revised program description and comparison will be submitted for NRC review and approval by October 31, 2005.

Although not characterized as an exception to the GALL Report in the PNP LRA, the applicant identifies the following exception to the GALL Report in a letter dated August 25, 2005:

Element: 3: Monitoring and Trending
Exception: The generally accepted definition of common tendon does not completely correspond with the XI.S2, "ASME Section XI Subsection IWL," portion of

the Containment Inservice Inspection Program, and is considered to be an exception to the GALL Report. Common tendons were not defined at PNP until the 30-year tendon surveillance conducted in 2002. The selected tendons do not meet the desired criteria in that they have been detensioned during the first tendon surveillance in the early 1970s.

The GALL Report identifies the following recommendation for the "monitoring and trending" program element associated with the exception taken:

> For prestressed containments, trending of prestressing forces in tendons is required in accordance with paragraph (b)(2)(viii) of 10 CFR 50.55a. In addition to the random sampling used for tendon examination, one tendon of each type is selected from the first-year inspection sample and designated as a common tendon. Each common tendon is then examined during each inspection. This procedure provides monitoring and trending information over the life of the plant.

The applicant further states in the letter that this exception does not degrade the effectiveness of the program to assure an acceptable level of containment structural integrity at all times. The PNP Tendon Surveillance Program is designed to maintain the tendon force above minimum analysis requirements on a continuous basis from surveillance to surveillance. This is accomplished each surveillance by performing tendon force measurements, comparing the results against expected levels for tendon force, and assuring that any expected relaxation will not reduce tendon forces below minimum requirements beyond at least the next surveillance. Structural integrity does not rely solely on the projection of forces in a designated common tendon out to the end of plant life.

The project team finds the applicant's explanation for the exception acceptable on the following basis. Although a historic common tendon does not exist, common tendons have been designated going forward for the remaining current operating license period and potential extended license. The program is still effective since during each tendon surveillance, tendon force measurements are taken and compared against expected levels for tendon force. This assures that the expected tendon relaxation will not reduce the tendon forces below minimum requirements until the next surveillance. On the basis that the applicant has established common tendons going forward, containment structural integrity does not rely solely on common tendon surveillance results, and its review of operating experience for the Containment Inservice Inspection Program (see Section 2.5.5, below), the project team finds this exception to be acceptable.

2.5.4 Enhancements

None

2.5.5 Operating Experience

The applicant states, in the PNP LRA, that PNP has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events and assesses these for applicability to its own operations. In addition, the PNP Corrective Action Program (CAP) is used to track, trend and evaluate plant issues/events. Those issues and events, whether external or plant-specific, that are potentially significant to the Containment Inservice Inspection Program at PNP are evaluated. The Containment Inservice Inspection Program is augmented, as appropriate, if these evaluations show that program changes will enhance program effectiveness.

The applicant states, in the PNP LRA, that using the OEP and CAP to focus on industry and plant operating experience ensures that Containment Inservice Inspection Program issues are addressed in a timely manner and that age related deterioration within the scope of the Containment Inservice Inspection Program will be effectively managed throughout the license renewal period.

The applicant also states, in the PNP LRA, that a review of the industry operating experience related to the Containment Inservice Inspection Program revealed instances where degradation has occurred within containments. In completing its review, the applicant looked at related issues which included degradation of containment liner plates, concrete, coatings, moisture barriers, bellows, tendons and tendon wires, tendon anchor heads, and penetrations.

The applicant states, in the PNP LRA, that a review of the plant-specific operating experience revealed some instances where the Containment Inservice Inspection Program has been instrumental in discovering material degradation.

Containment degradation included:

- Liner plate corrosion
- Unacceptable tendon liftoff value
- Tendon gallery corrosion
- Tendon grease leakage
- Moisture barrier not in place
- Tendon sheath water intrusion

In addition, the applicant states, in the PNP LRA, that the Containment Inservice Inspection Program has been effective in identifying material degradation in a timely manner, thus ensuring that age related degradation of the containment will be effectively managed throughout the license renewal period.

Furthermore, the applicant states, in the PNP LRA, that the PNP Containment Inservice Inspection Program has demonstrated that it provides reasonable assurance that aging effects are being adequately managed for the containment. This has been demonstrated through NRC inspection reports, INPO evaluations, audits, self-assessments, and the Corrective Action Program.

A review of the above operating experience related to the applicant’s Containment Inservice Inspection Program by the project team revealed that there have been no significant failures of the containment shell concrete, the post-tensioning system and steel pressure retaining elements due to degradation. The PNP operating experience listed above is typical of the types of minor material degradation that are found on the interior, the exterior and with the tendon system for a prestressed concrete containment. The project team did not identify any operating experience related to the applicant’s Containment Inservice Inspection Program that would require any modification to the PNP program.

The project team reviewed the operating experience provided in the PNP LRA, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical staff, the project team concludes that, **predicated on satisfactory resolution of OI-2.5.2-1**, the applicant’s Containment Inservice Inspection Program will adequately manage the aging effects that are identified in the PNP LRA for which this AMP is credited.

2.5.6 FSAR Supplement

The applicant provides its FSAR Supplement for the Containment Inservice Inspection Program in PNP LRA, Appendix A, Section A2.7, which states that the Containment Inservice Inspection (ISI) Program is designed to ensure that containment shell concrete, the post-tensioning system and steel pressure retaining elements continue to provide an acceptable level of structural integrity. In addition, it is designed to ensure that the liner (with associated moisture barriers), other leakage limiting steel barriers and pressure retaining bolted connections have not degraded.

The project team finds the FSAR Supplement to be an acceptable summation of the Containment Inservice Inspection Program.

The project team reviewed the FSAR Supplement for PNP AMP B2.1.7, 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).

2.5.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. In addition, the project team has reviewed the exceptions and the associated justifications and determined that the AMP, with the exceptions is adequate to manage the aging effects for which it is credited. The project team finds that, **predicated on satisfactory resolution of OI-2.5.2-1,** 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).

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

2.6 CONTAINMENT LEAKAGE TESTING PROGRAM (PNP AMP B2.1.8)

In PNP LRA, Appendix B, Section B2.1.8, the applicant states that PNP AMP B2.1.8, “Containment Leakage Testing Program,” is an existing plant program that is consistent with GALL AMP XI.S4, “10 CFR 50, Appendix J.”

2.6.1 Program Description

The applicant states, in the PNP LRA, that this program is an existing program that ensures that containment leakage is maintained below the upper acceptance limit of L_a = 0.1%/day. This testing program, in conjunction with PNP AMP B2.1.7, Containment Inservice Inspection Program, provides assurance that age related (and other) deterioration of the containment leakage limiting boundary is appropriately managed to ensure that postulated post-accident releases are limited to an acceptable level. The program is implemented through the following testing and examination activities:

- Overall containment leakage (integrated leakage rate or Type A) test to assess the leak tight integrity of the entire pressure boundary.
- Visual examinations of the containment exterior and interior.
- Local (Type B and C) tests to assess the leak tight integrity of individual penetrations.

2.6.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B2.1.8 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 PNP AMP B2.1.8, including basis document, LR-AMPBD-09-CONTLRT, “Containment Leakage Testing Program,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.S4.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B2.1.8 and associated basis documents against GALL AMP XI.S4 for consistency.

Also, in implementing Option B for 10 CFR Appendix J testing, PNP requested certain current licensing basis exemptions from the requirements of 10 CFR 50 Appendix J and exceptions from certain guidance of NRC Regulatory Guide 1.163, “Performance-Based Containment Leak Test Program,” and Nuclear Energy Institute (NEI) guideline NEI 94-01, “Industry Guideline for Implementing Performance-Based Option of 10 CFR 50 Appendix J.” Regulatory Guide 1.163 stipulates that containment purge valves are to be tested at least every 30 months. By NRC Docketed letter TAC MB0855, “Palisades Plant Issuance of Amendment RE: Option B Containment Leak Rate Testing,” the NRC approved application of performance based test interval extension criteria to the PNP containment purge valves. However, PNP retained the Improved Technical Specification requirement to perform a leakage test on these valves every 184 days. 10 CFR 50, Appendix J, Option B states that Type B tests are to be done at accident pressure. By NRC Docketed letter TAC 64339, “Amendment No. 126 to Provisional Operating License No. DPR-20,” the NRC has approved testing of the PNP personnel air lock door seals at 10 psig rather than 53 psig. NEI 94-01 specifically requires that air lock door seals be tested following air lock door use when containment integrity is required. By NRC Docketed letter TAC M94528, “Palisades Plant-Issuance of Amendment RE: Containment Emergency Escape Air Lock Testing, and Exemption From Certain Requirements of 10 CFR Part 50, Appendix J,” the NRC approved the PNP request to verify seal contact in lieu of performing a leakage test on emergency escape air lock door seals. These plant-specific alternatives were approved by the NRC during PNP's implementation of Option B.

The project team reviewed the NRC issued PNP technical specification amendments which approved the applicant's adoption of Option B with the exemptions. The applicant stated that these exemptions are not considered to be exceptions to GALL AMP XI.S4 elements because they are part of the current licensing basis. The project team agrees and finds these changes to the PNP Containment Leakage Testing Program acceptable because NRC approval was obtained during implementation of Option B for 10 CFR Appendix J testing and they are contained in the PNP technical specifications.

The project team reviewed those portions of the PNP Containment Leakage Testing Program for which the applicant claims consistency with GALL AMP XI.S4 and finds that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's Containment Leakage Testing Program provides reasonable assurance that age related (and other) deterioration of the containment leakage limiting boundary is appropriately managed to ensure that postulated post-accident releases are limited to an acceptable level for the period of extended operation. The project team finds the applicant's Containment Leakage Testing Program acceptable because it conforms to the recommended GALL AMP XI.S4, "10 CFR 50, Appendix J."

2.6.3 Exceptions to the GALL Report

None

2.6.4 Enhancements

None

2.6.5 Operating Experience

The applicant states, in the PNP LRA, that PNP has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events and assesses these for applicability to its own operations. In addition, the PNP Corrective Action Program (CAP) is used to track, trend and evaluate plant issues/events. Those issues and events, whether external or plant-specific, that are potentially significant to the leak-tight integrity of the PNP containment are evaluated. The Containment Leakage Testing Program is augmented, as appropriate, if these evaluations show that program changes will enhance leak-tight integrity and, as a consequence, operational safety.

The applicant states, in the PNP LRA, that using the OEP and CAP to focus on industry and plant operating experience ensures that containment leakage issues are addressed in a timely manner and that age related deterioration of containment leak-tightness is effectively managed throughout the license renewal period.

NUREG-1493, "Performance-Based Containment Leak-Test Program," which provided the technical justification for the performance-based leakage testing program defined in Appendix J, Option B, includes a summary of industry testing experience. This summary demonstrates that performance based leakage testing programs will adequately detect problems at an early stage and are, therefore, acceptable for managing containment leak tight integrity. The NUREG does include a few contrary examples. However, in most cases, these examples illustrate lack of administrative control rather than any technical deficiency in performance based programs. While NUREG-1493 does not specifically address license renewal, it does show, by inference, that performance based leakage testing programs are effective as an aging management tool.

In addition, the applicant states, in the PNP LRA, that no significant problems have been found during periodic Type A tests at PNP. This confirms that the local leakage rate testing program (in conjunction with periodic containment examinations) has always detected developing deterioration before this could result in a loss of containment leak tight integrity (as defined by overall leakage exceeding L_a).

The applicant states, in the PNP LRA, that instances of excessive (in excess of the assigned administrative limit) component leakage have been uncovered during the performance of Type B and C tests over the operating lifetime of the plant. Most instances of excessive leakage are the result of active isolation valve seat deterioration. Some are the result of air lock door seal misalignment or damage. Active isolation valves and air lock door seals (which are replaced at least once every three refueling outages), however, are not long lived, passive components which are subject to aging management under this program.

The applicant also states, in the PNP LRA, that instances of problems with passive components are relatively rare. Two reported instances were found in a search through records going back through the mid 1980's. These are summarized below.

- In 1983 a leak of about 0.1 L_a was found at one conductor seal in electrical penetration EZ-104. The leak affected only one barrier so that minimum pathway leakage through the penetration was still essentially nil. The entire penetration was replaced during the 1985 outage.

- During a September 2001 Type C test on penetration MZ-66, a measured leak of about 0.15 L_a was identified primarily to leakage through a manual isolation gate valve. The cause of the leakage was determined to be debris on the seat. The problem was corrected and leakage restored to an acceptable level. Since the measured leakage was identified primarily to a single barrier, minimum pathway leakage through the penetration remained at a relatively low level.

Furthermore, the applicant states, in the PNP LRA, that the PNP Containment Leakage Testing Program has demonstrated that it provides reasonable assurance that aging effects are being managed for within scope SSC. Additionally, this has been demonstrated through inspection reports, program health reports, and the Corrective Action Program.

The project team review of the above operating experience related to the applicant's Containment Leakage Testing Program revealed that there have been no significant failures of the containment leakage barriers due to degradation. The cause of any significant leakage during recent containment leakage testing was debris on the seat of a manual isolation gate valve. The leakage was not due to degradation from aging. The project team did not identify any operating experience related to the Containment Leakage Testing Program that would require any modification to the PNP program.

The project team reviewed the operating experience provided in the PNP LRA, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

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

2.6.6 FSAR Supplement

The applicant provides its FSAR Supplement for the Containment Leakage Testing Program in PNP LRA, Appendix A, Section A2.8, which states that the Containment Leakage Testing Program ensures that containment leakage is maintained below the upper acceptance limit of L_a = 0.1%/day. This testing program, in conjunction with the Containment Inservice Inspection Program, provides assurance that age related (and other) deterioration of the containment leakage limiting boundary is appropriately managed to ensure that postulated post-accident releases are limited to an acceptable level. The program is implemented through the following testing and examination activities:

- Overall containment leakage (integrated leakage rate or Type A) test to assess the leak tight integrity of the entire pressure boundary.
- Visual examinations of the containment exterior and interior.
- Local (Type B and C) tests to assess the leak tight integrity of individual penetrations.

The project team finds the FSAR Supplement to be an acceptable summation of the applicant's Containment Leakage Testing Program.

The project team reviewed the FSAR Supplement for PNP AMP B2.1.8, 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).

2.6.7 Conclusion

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

On the basis of its review of the FSAR Supplement for this program, the project team finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

2.7 DIESEL FUEL MONITORING AND STORAGE PROGRAM (PNP AMP B2.1.9)

In PNP LRA, Appendix B, Section B2.1.9, the applicant states that PNP AMP B2.1.9, "Diesel Fuel Monitoring and Storage Program," is an existing plant program that is consistent with GALL AMP XI.M30, "Fuel Oil Chemistry," with an exception and enhancements.

2.7.1 Program Description

The applicant states, in the PNP LRA, that this program assures the continued availability and quality of fuel oil to be used in diesel generators and diesel fire pumps. The program includes (a) monitoring and trending of fuel oil chemistry to maintain fuel oil quality and mitigate corrosion, (b) periodic draining, cleaning, and internal inspection of fuel oil storage tanks, and (c) verification of program effectiveness by a one-time measurement of fuel oil storage tank bottom thickness confirming the absence of an aging effect. Fuel oil quality is maintained by monitoring and controlling fuel oil contamination in accordance with the guidelines of the American Society for Testing Materials (ASTM) Standards D1796, D2276, D2709, and D4057.

Additionally, the applicant states, in the PNP LRA, that 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. However, corrosion may occur at locations in which contaminants may accumulate, such as tank bottoms. Accordingly, the effectiveness of the program is verified, through visual inspection and a one-time ultrasonic thickness measurement of fuel oil storage tank bottom surface, to ensure that significant degradation is not occurring and that applicable component intended functions will be maintained during the period of extended operation.

The applicant also states in the PNP LRA that, per plant procedures, samples of new fuel oil are obtained and analyzed to verify quality prior to off-loading into storage tanks. Additionally, samples of new fuel are obtained for later analysis for particulates.

2.7.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B2.1.9 is consistent with GALL AMP XI.M30, 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 PNP AMP B2.1.9, including basis document, LR-AMPBD-10-DSLFUEL, "Diesel Fuel Monitoring and Storage Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M30.

GALL AMP XI.M30 recommends, in the "acceptance criteria" program element, that Modified ASTM D2276, Method A be used for determination of particulates. The modification consists of using a filter with a pore size of 3.0 µm, instead of 0.8 µm. In reviewing the PNP testing procedure, Chemistry Procedure CH 3.52, "Determination of Particulate Contamination in Fuel Oils," which references this ASTM standard for particulate testing, the applicant is using a 0.8 µm pore filter instead of the GALL Report recommended 3.0 µm filter size. The project team finds this acceptable because use of the unmodified version is considered to be more conservative than the modified version because it uses a smaller filter pore size. The smaller filter pore size will result in collecting more particulate material from the fuel oil which would lead to a conservative estimate of the amount of particulates present in the fuel oil.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B2.1.9 and associated basis documents against GALL AMP XI.M30 for consistency.

The project team reviewed those portions of the applicant's Diesel Fuel Monitoring and Storage Program for which the applicant claims consistency with GALL AMP XI.M30 and finds that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's Diesel Fuel Monitoring and Storage Program provides reasonable assurance that the aging effect of loss of material due to general, pitting and microbiological influenced corrosion is adequately managed by monitoring and controlling conditions that would cause this aging effect and by monitoring the effectiveness of the program through surveillance and testing. The project team finds the applicant's Diesel Fuel Monitoring and Storage Program acceptable because it conforms to the recommended GALL AMP XI.M30, "Fuel Oil Chemistry," with the exceptions and enhancements as described below.

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

The applicant states, in the PNP LRA, that the exception to the GALL Report element is as follows:

Element:	2: Preventive Actions
Exception:	PNP does not add biocides, stabilizers or corrosion inhibitors to the fuel oil.

The GALL Report identifies 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.

In regard to not using biocides in the fuel oil, the applicant states, in the PNP LRA, that there is no operational experience that indicates a positive test for microbiological growth. In the event a test would come back positive for microbiological growth, an evaluation would be performed, per the Corrective Action Program, to determine whether addition of biocides should be performed.

The project team finds this aspect of the exception to be acceptable based on the lack of physical evidence from the plant operating experience as well as the commitment through the Corrective Action Program to investigate the use of biocides, if test results indicate the need. The lack of physical evidence was confirmed during the interview of the applicant's technical staff and through a review of selected test results.

In regard to not using fuel oil stabilizers, the applicant states, in the PNP LRA, that the fuel oil storage tanks have a relatively high fuel oil turnover rate. Tank T-10A typically has an operating volume of 38,000 gallons, with an average fuel consumption of 76,000 gallons per year. Tank

T-926 has a typical operating volume of 15,000 gallons, with an average fuel consumption rate of 35,000 gallons per year. Because of the high fuel turnover rate in the storage tanks, the applicant has determined that there is no need to add fuel oil stabilizers to the diesel fuel. This is further strengthened by surveillance testing for the presence of particulates which, if significant, would result in the filtering of the tank contents. For example, the stored fuel in the T-10A fuel oil storage tank is filtered approximately every three years, or as needed. The project team finds this aspect of the exception to be acceptable based on the relatively short residence time of the fuel oil in the storage tanks.

In regard to not adding corrosion inhibitors to the fuel oil, the applicant states, in the PNP LRA, that the fuel oil is procured to meet ASTM D975 standards, which include specifications and acceptance criteria for a copper strip corrosion test. Additionally, samples are periodically analyzed by an off-site facility for relative corrosivity of the fuel oil by a copper strip corrosion test. All copper strip corrosion tests performed in the last five years have returned results that meet the ASTM standard. Consequently, PNP does not add corrosion inhibitors to the diesel fuel.

During the interview of the plant's technical staff, the project team confirmed that the applicant specifies the copper strip corrosion test as part of its fuel procurement specification and then performs a receipt acceptance test on a fuel oil sample with an outside laboratory. The applicant also indicated, during the audit and review, that the fuel oil is periodically tested for relative corrosivity by an outside laboratory. The project team finds this aspect of the exception to not use corrosion inhibitors to be acceptable based on the new fuel oil testing and the periodic test of the fuel oil in the tanks.

2.7.4 Enhancements

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

> Element: 2: Preventive Actions
> Enhancement: Develop and implement procedures for periodic draining and cleaning of fuel oil storage tanks, emergency diesel generator day tanks, and diesel fire pump day tanks. Also, develop and implement procedures for periodic draining of water accumulated in the bottom of the fuel oil storage tanks, emergency diesel generator day tanks, and diesel fire pump day tanks.

The GALL Report identifies the following recommendations for the "preventive actions" program element associated with this enhancement:

> 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.

The applicant states, in the PNP LRA, that it will develop a procedure for the periodic draining and cleaning of the fuel oil storage tanks to remove any water and sediment. The project team finds that these measures are effective in mitigating corrosion inside diesel fuel oil tanks. On this basis, the project team finds this enhancement acceptable as such changes to the applicant’s program will provide additional assurance that the effects of aging will be adequately managed. This enhancement is consistent with the GALL Report recommendations.

In addition, the applicant states, in the PNP LRA, that the enhancement in meeting the GALL Report element is as follows:

Element:	4: Detection of Aging Effects
Enhancement:	Develop and implement procedures for periodic ultrasonic measurement of thickness of the bottom of fuel oil storage tanks, emergency diesel generator day tanks, and diesel fire pump day tanks. Also, the procedures for draining and cleaning of the tanks (Preventive Actions) shall include steps to perform a visual inspection of interior tank surfaces for signs of degradation or corrosion, with acceptance criteria, corrective actions, and documentation of inspection results.

The GALL Report identifies the following recommendations for the “detection of aging effects” program element associated with the enhancement:

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

The applicant states, in the PNP LRA, that it will develop implementation procedures for performing non-destructive testing and visual inspections to ensure that significant degradation of the tank and tank bottoms is not occurring without being detected. The project team finds that the use of visual inspections and non-destructive testing to detect any signs of potential adverse degradation is consistent with the GALL Report recommendations for this program element. On this basis, the project team finds this enhancement acceptable as such changes to the applicant’s program will provide additional assurance that the effects of aging will be adequately managed. This enhancement is consistent with the GALL Report recommendations.

2.7.5 Operating Experience

The applicant states, in the PNP LRA, that PNP has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events and assesses these for applicability to its own operations. In addition, the PNP Corrective Action Program (CAP) is used to track, trend and evaluate plant issues/events. Those issues and events, whether external or plant-specific, that are potentially significant to the Diesel Fuel Monitoring and Storage Program at PNP are evaluated. The Diesel Fuel Monitoring and Storage Program is augmented, as appropriate, if these evaluations show that program changes will enhance program effectiveness.

The applicant states, in the PNP LRA, that using the OEP and CAP to focus on industry and plant operating experience ensures that Diesel Fuel Monitoring and Storage Program issues are addressed in a timely manner, and that age-related deterioration of SSCs within the scope of the Diesel Fuel Monitoring and Storage Program will be effectively managed throughout the license renewal period.

The applicant also states, in the PNP LRA, that a review of industry operating experience associated with the Diesel Fuel Monitoring and Storage Program and aging reveals issues and instances related to the following:

- Fuel contamination leading to corrosion of fuel oil system components.
- Improper zinc coating curing and epoxy application by the manufacturer leads to zinc-fuel reaction creating adverse corrosion.
- Fuel oil leak caused by improper outer coating application.

The applicant states, in the PNP LRA, that various related NRC and/or industry generic communications have been issued, and, in turn, have been incorporated into the program as applicable.

In addition, the applicant states, in the PNP LRA, that a review of plant-specific operating experience related to the Diesel Fuel Monitoring and Storage Program was performed, and no aging issues were identified.

The project team finds that most of the corrective action documents reviewed dealt with the exceedance of administrative limits on particulates. Appropriate corrective actions such as filtering of the tanks as needed were implemented in response to these corrective action reports. On this basis, the project team concludes that there are no identified aging effects that are not being effectively managed by the applicant's current program.

The project team reviewed the operating experience provided in the PNP LRA, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

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

2.7.6 FSAR Supplement

The applicant provides its FSAR Supplement for the Diesel Fuel Monitoring and Storage Program in PNP LRA, Appendix A, Section A2.9, which states that the Diesel Fuel Monitoring and Storage Program assures the continued availability and quality of fuel oil to be used in diesel generators and diesel fire pumps. The program includes (a) monitoring and trending of fuel oil chemistry to maintain fuel oil quality and mitigate corrosion, (b) periodic draining, cleaning, and internal inspection of fuel oil storage tanks, and (c) verification of program effectiveness by a one-time measurement of fuel oil storage tank bottom thickness confirming the absence of an aging effect. Fuel oil quality is maintained by monitoring and controlling fuel oil contamination in accordance with the guidelines of the ASTM Standards D1796, D2276, D2709, and D4057.

The commitments for the PNP AMP B2.1.9 program enhancements are contained in the applicant's March 22, 2005 (ML050940434) letter to the NRC.

The project team reviewed the FSAR Supplement and enhancement commitments for PNP AMP B2.1.9, found that they are consistent with the GALL Report, and determined that the FSAR Supplement 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).

2.7.7 Conclusion

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

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

2.8 FIRE PROTECTION PROGRAM (PNP AMP B2.1.10)

In PNP LRA, Appendix B, Section B2.1.10, the applicant states that PNP AMP B2.1.10, "Fire Protection Program," is an existing plant program that is consistent with GALL AMP XI.M26, "Fire Protection" and GALL AMP XI.M27, "Fire Water System," with exceptions and enhancements.

2.8.1 Program Description

The applicant states, in the PNP LRA, that this program includes (a) fire barrier inspections, (b) electric and diesel-driven fire pump tests, and (c) periodic maintenance, testing, and inspection of water-based fire protection systems. Periodic visual inspections of fire barrier penetration seals, fire dampers, fire barrier walls, ceilings and floors, and periodic visual inspections and functional tests of fire-rated doors are performed to ensure that functionality and operability is maintained. Periodic testing of the fire pumps ensures that an adequate flow of firewater is supplied and that there is no degradation of diesel fuel supply lines. Periodic maintenance, testing and inspection activities of water-based fire protection systems provides reasonable assurance that fire water systems are capable of performing their intended function. Inspection and testing include periodic hydrant inspections, fire main flushing, sprinkler inspections, pipe wall thickness testing and flow tests.

The applicant also states, in the PNP LRA, that this program manages aging of the fire protection components through detailed fire barrier inspections of fire barrier penetration seals, and fire rated doors. Aging related degradation of fire barrier walls, ceilings and floors are managed by the Structural Monitoring Program. Aging of the diesel-driven fire pump's fuel oil supply line is managed through regularly scheduled fire pump performance tests.

The applicant states that its Fire Protection Program also manages aging of fire water systems through periodic hydrant inspections, flushes, and flow tests, fire main flushing, sprinkler system inspections, and pipe wall thickness testing. The fire water system pressure and flow are continuously monitored in the plant control room through annunciator alarms and personnel.

The applicant states, in the PNP LRA, that aging management of spare cables for Appendix R required equipment is also included within the scope of the Fire Protection Program. These spare cables are located in various storage locations in the event they are needed for repairs to key components damaged by an Appendix R type fire. The Fire Protection Program credits PNP AMP B2.1.12, “Non-EQ Electrical Commodities Condition Monitoring Program,” for aging management of these cables.

Furthermore, the applicant states, in the PNP LRA, that the NRC issued Interim Staff Guidance (ISG)-4, “Aging Management of Fire Protection Systems for License Renewal,” in December 2002. This staff position clarified the guidance of GALL AMP XI.M26, “Fire Protection,” and GALL AMP XI.M27, “Fire Water System,” with regard to wall thinning of fire protection piping due to internal corrosion, testing of sprinkler heads, and valve line-up inspections of halon/carbon dioxide fire suppression systems. The Fire Protection Program is based on the aging management program guidance presented in ISG-4.

2.8.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B2.1.10 is consistent with GALL AMP XI.M26 and GALL AMP XI.M27, 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 PNP AMP B2.1.10, including basis document, LR-AMPBD-13-FIREPROT, “Fire Protection Program,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.M26 and GALL AMP XI.M27.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B2.1.10 and associated basis documents against GALL AMP XI.M26,GALL AMP XI.M27, and ISG-4 for consistency.

ISG-4 and GALL AMP XI.M26 recommend periodic inspection and testing of the halon/carbon dioxide fire suppression systems. During the audit and review, the project team noted that the inspection of halon/carbon dioxide suppression systems is not included in the scope of PNP AMP B2.1.10. In a letter dated August 25, 2005, the applicant states that there are no halon/carbon dioxide fire protection systems within the scope of license renewal. There were no halon/carbon dioxide fire protection systems brought into scope as a result of 10 CFR 54.4(a)(2). The applicant explained that PNP uses water spray to protect some areas (cable spreading room, etc.) that are typically protected by either carbon dioxide or halon at most plants. Since there are no halon/carbon dioxide fire protection systems within the scope of license renewal, the Fire Protection Program is not required to discuss managing of halon/carbon dioxide fire protection systems. The project team finds this acceptable, since the applicant clarified that there are no halon or carbon dioxide systems within the scope of license renewal that require aging management.

The applicant states that its Fire Protection Program focuses on managing loss of material due to corrosion, MIC, or biofouling of carbon steel and cast-iron components exposed to water. During the audit and review, the project team noted that PNP LRA Table 3.3.2-7 lists bare copper, bronze, copper alloy and stainless steel components in raw water as components whose aging effects are managed by the Fire Protection Program. The applicant, in its letter dated August 25, 2005, states that its Fire Protection Program is intended to include all materials/components of PNP LRA Table 3.3.2-7 that credit the Fire Protection Program. The last sentence of the first paragraph of program element, scope of program, on page B-74 of the PNP LRA is revised to read, “The program focuses on managing loss of material due to corrosion, MIC, or biofouling of components; and aging management of fire barrier components.” The project team finds this response acceptable since the applicant revised the PNP LRA to include all the materials that are managed by the Fire Protection Program.

The project team reviewed those portions of the Fire Protection Program for which the applicant claims consistency with GALL AMP XI.M26 and GALL AMP XI.M27, and ISG-4 recommendations and finds that they are consistent with the GALL Report AMPs. Furthermore, the project team concludes that the applicant’s Fire Protection Program provides reasonable assurance that the aging of fire protection components through detailed fire barrier inspections of fire barriers penetration seals, and fire rated doors, and aging effects of the diesel-driven fire pump’s fuel oil supply line. The Fire Protection Program also manages aging of the fire water systems within the scope for the period of extended operation through periodic hydrant inspections, flushes, and flow tests, fire main flushing, sprinkler system inspections, and pipe wall testing. The project team finds the applicant’s Fire Protection Program acceptable because it conforms to the recommended GALL AMP XI.M26, “Fire Protection,” GALL AMP XI.M27, “Fire Water System,” and ISG-4 with the exceptions and enhancements as described below.

2.8.3 Exceptions to the GALL Report

The applicant states, in the PNP LRA, that the exception to the GALL Report element is as follows:

> Element: 4: Detection of Aging Effects (XI.M26)
> Exception: PNP does not qualify the personnel performing the visual inspections of fire barrier walls, ceilings, floors, penetration seals and fire doors to the ASME Code type of qualification as stated in the GALL Report and ISG-04.

The GALL Report identifies the following recommendation for the detection of aging effects program element associated with the first exception taken:

> Visual inspection (VT-1 or equivalent) of 10% of each type of seal in walkdowns is performed at least once every refueling outage. If any sign of degradation is detected within that 10%, the scope of the inspection and frequency is expanded to ensure timely detection of increased hardness and shrinkage of the penetration seal before the loss of the component intended function. Visual inspection (VT-1 or equivalent) of the fire barrier walls, ceilings, and floors performed in walkdown at least once every refueling outage ensures timely detection for concrete cracking, spalling, and loss of material. Visual inspection (VT-3 or equivalent) detects any sign of degradation of the fire door such as wear

and missing parts. Function tests promptly detect deficiencies in operational conditions. Periodic visual inspection and function tests detect degradation of the fire doors before there is a loss of intended function.

The applicant states, in the PNP LRA, that per plant procedures, inspectors for fire barriers/doors/fire seals are appropriately qualified to perform those inspections, but are not necessarily qualified to VT-1 or VT-3. There are no regulatory or other requirements specifying that these inspections be performed to VT-1 or VT-3 standards.

During the audit and review, the project team asked the applicant to provide technical justification as to how the visual inspection method that the applicant will use is equivalent and assures the same level of flaw identification and documentation as would be achieved by VT-1 and VT-3.

The applicant, in a letter dated August 25, 2005, states the following:

> The ASME Section XI Code identifies inspection and acceptance criteria to apply to various systems/components (i.e., IWB-3520.1, IWB-3520.2) when using a VT-1 or VT-3 examination. IWA-2211, VT-1 Examination states: “VT-1 examinations are conducted to detect discontinuities and imperfections on the surfaces of components, including such conditions as cracks, wear, corrosion, or erosion.“ IWA-2213, VT-3 Examination states: “VT-3 examinations are conducted to determine the general mechanical and structural condition of components and their supports by verifying parameters such as clearances, settings, and physical displacements; and to detect discontinuities and imperfections, such as loss of integrity at bolted or welded connections, loose or missing parts, debris, corrosion, wear, or erosion. VT-3 includes examinations for conditions that could affect operability or functional adequacy of snubbers and constant load and spring type supports.”
>
> Palisades' fire barrier penetration seal inspection surveillance procedure contains detailed inspection criteria, inspection methods, and acceptance criteria for each of the installed seal types. These requirements are equivalent to the level of detail required for a VT-1 inspection conducted under ASME Section XI. Completed inspection procedures are signed off as acceptable, or any unacceptable condition is documented in the Corrective Action System and repaired or replaced as required. NMC considers this as equivalent to VT-1 or VT-3 examinations as used in ASME Section XI and discussed in GALL.
>
> It is also noted that the GALL Report, draft Revision 1, (as publicly released on August 12, 2005), Section XI.M26, removes reference to VT-1 and VT-3 from Detection of Aging Effects. It instead specifies that 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.

The project team reviewed the applicant's response. Since the applicant clarified that inspections of fire barriers/doors/fire seals are performed by the qualified inspectors and inspection procedures are equivalent to VT-1 or VT-3 examinations, the project team finds this acceptable.

The applicant also states, in the PNP LRA, that the exception to the GALL Report element is as follows:

> Element: 5: Monitoring and Trending (XI.M27)
> Exception: At PNP, inspection and testing is performed as outlined in Fire Protection Implementing Procedures.

The GALL Report identifies the following recommendation for the monitoring and trending program element associated with the second exception taken:

> Results of system performance testing are monitored and trended as specified by the National Fire Protection Association (NFPA) codes and standards.

The applicant states, in the PNP LRA, that at PNP, inspection and testing is performed as outlined in its Fire Protection Implementing Procedures. NFPA codes of record are identified in the PNP Fire Protection Program Report (FPPR) and/or FSAR.

During the audit and review, the project team asked the applicant to elaborate on the differences between NFPA code requirements NFPA 25 for monitoring and tending and the PNP Fire Protection Program. In a letter dated August 25, 2005, the applicant states the following:

> Based on discussions during the interview and a detailed review of the applicable sections of NFPA-25, it has been concluded that Palisades complies with the specific monitoring and trending of results as specified in NFPA-25. This new understanding serves as the basis for not taking exception to the GALL on this issue. NMC's review of NFPA-25 for monitoring and trending of system performance testing identified two sections where requirements are stated.
>
> NFPA-25 step 5-3.5.2 states that the pump test curve shall be compared to the unadjusted field acceptance test curve and the previous annual test curves.
>
> This guidance is demonstrated in the fire suppression water system functional test and fire pump capacity test procedure which states, "This procedure facilitates trending hydraulic performance of Fire Pumps P-9A, P-9B, and P-41, including comparison of current pump performance with original and historical pump performance."
>
> NFPA-25 step 4-3.1 states that underground and exposed piping shall be flow tested to determine the internal condition of the piping at minimum 5-year intervals. Flow test shall be made at flows representative of those expected during a fire for the purpose of comparing the friction loss characteristics of the pipe with those expected for the particular type of pipe involved, with due consideration given to the age of the pipe and to the results of previous flow

> tests. Any flow test results that indicate deterioration of available water flow and pressure shall be investigated to the complete satisfaction of the authority having jurisdiction to ensure that adequate flow and pressure are available for fire protection.
>
> This testing guidance is demonstrated in the fire suppression water system flow test procedure, which states, “To determine operability of fire suppression water system by performing a flow test to determine if there is any system degradation or obstruction. The procedure contains acceptance criteria and requirements to initiate a condition report if acceptance criteria are not met.” Flow testing is required to be performed every three (3) years.
>
> Although Palisades is not committed to the requirements of NFPA-25, the Palisades program does meet the requirements as identified above. Continued implementation of this program provides reasonable assurance that the effects of aging of the applicable components will be adequately managed for the period of extended operation.

The project team finds this acceptable and agrees with removing this exception, since the applicant clarified that the PNP Fire Protection Program does meet the requirements of NFPA-25.

In addition, the applicant states, in the PNP LRA, that the exception to the GALL Report element is as follows:

Element:	6: Acceptance Criteria	(XI.M26)
Exception:	PNP inspection acceptance criteria states that no cracks of ¼" wide or greater are allowed.	

The GALL Report identifies the following recommendation for the “acceptance criteria” program element associated with the third exception taken:

> Inspection results are acceptable if there are no visual indications of cracking, separation of seals from walls and components, separation of layers of material, or ruptures or punctures of seals.

The applicant states, in the PNP LRA, that PNP inspection acceptance criteria states that no cracks of ¼" wide or greater are allowed. The applicant also states that the acceptance criteria is derived from fire test reports, and the project team finds this acceptable.

During the AMP audit and review, the project team asked the applicant to provide justification for acceptance of cracks no wider than ¼". The applicant was also asked to identify where any cracks or defections in seals have been observed. In a letter dated August 25, 2005, the applicant states the following:

> LRA Section B2.1.10, Fire Protection Program, Exceptions to NUREG 1801, is hereby revised to delete exception 3 on page B-73. In addition, Acceptance Criteria on page B-79 is hereby revised to read as follows:

> Acceptance criteria are defined in the Palisades procedures used to perform tests and inspections of the Fire Protection System. Fire seal and conduit wrapping inspection results are acceptable if there are no visual indication of cracking, separation of seals from building structures and components, and no rupture or puncture of seals. Fire door inspection results are acceptable if there are no visual indications of wear, holes, damaged or missing parts, and clearances are within limits. Diesel-driven fire pump inspections are acceptable if there is no evidence of corrosion or leaks on the fuel oil supply line. Acceptance criteria for the diesel-driven fire pump capacity is contained within the test procedure.

The project team reviewed the applicant's response. The project team finds the revised PNP LRA B2.1.10, acceptance criteria and clarification that no visual indication of cracking, separation of seals from building structures and components, and no rupture or puncture of seals, acceptable. Fire door inspection results are acceptable if there are no visual indications of wear, holes, damaged or missing parts, and clearances are within limits. Therefore, the project team agrees that the revised PNP AMP B2.1.10 acceptance criteria program element is consistent with GALL AMP XI.M26, "Fire Protection," as clarified in ISG-4.

2.8.4 <u>Enhancements</u>

The applicant states, in the PNP LRA, that the enhancement in meeting the GALL Report elements is as follows:

Elements:	4: Detection of Aging Effects 5: Monitoring and Trending	(XI.M26)
Enhancement:	The Structural Monitoring Program implementing procedures shall be revised to include specific inspection criteria and documentation requirements for verifying that walls, ceilings and floors that serve as Fire Protection Program fire barriers are verified to be free from aging related degradation that would impact the fire barrier's intended function.	

The GALL Report identifies the following recommendations for the "detection of aging effects" and "monitoring and trending" program elements associated with the first enhancement:

> Visual inspection (VT-1 or equivalent) of the fire barrier walls, ceilings, and floors performed in walkdown at least once every refueling outage ensures timely detection for concrete cracking, spalling, and loss of material.
>
> Concrete cracking, spalling, and loss of material are detectable by visual inspection and, based on operating experience, visual inspection performed at least once every refueling outage detects any sign of degradation of the fire barrier walls, ceilings, and floors before there is a loss of the intended function.

The applicant states, in the PNP LRA under detection of aging effects, that its Fire Protection Program credits PNP AMP B2.1.19, "Structural Monitoring Program," for aging management of fire barrier walls, ceilings and floors. Fire doors are periodically tested and visually inspected by qualified inspectors for signs of corrosion, wear, or missing parts to ensure that functionality and operability is maintained. Also, PNP AMP B2.1.10, under the monitoring and trending program element, states that the Fire Protection Program credits the Structural Monitoring Program for monitoring the condition of fire barrier walls, ceilings and floors. At least 10% of the fire barrier penetration seals are visually inspected every 18 months for signs of age-related degradation, such as seal separation from walls and components, cracking, rupture and puncture of seals. Fire doors are tested and/or visually inspected by qualified inspectors semi-annually for signs of corrosion, wear, missing parts, and proper clearances to ensure that functionality and operability is maintained.

During the audit and review, the project team verified that aging effects of fire walls, ceilings and floors are managed by the applicant's Structural Monitoring Program. The project team finds that by revising the Fire Protection Program procedures to more specifically address the aging related degradation and expectations for documentation of fire door conditions, it will ensure degradation due to aging of all fire doors within the scope of license renewal is detected before there is a loss of intended function. After implementation of this enhancement, this program element will be consistent with the GALL Report. On this basis, the project team finds this enhancement acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

The applicant also states, in the PNP LRA, that the enhancement in meeting the GALL Report elements is as follows:

Elements:	1: Scope of Program 4: Detection of Aging Effects 5: Monitoring and Trending	(XI.M26)
Enhancement:	Plant procedures shall be revised to more specifically address aging related degradation and expectations for documentation of fire door condition.	

The GALL Report identifies the following recommendations for the "scope of program," "detection of aging effects," and "monitoring and trending" program elements associated with the second enhancement:

> Visual inspection (VT-3 or equivalent) detects any sign of degradation of the fire door such as wear and missing parts. Function tests promptly detect deficiencies in operational conditions. Periodic visual inspection and function tests detect degradation of the fire doors before there is a loss of intended function.
>
> Wear, missing parts, or holes in the fire door are detectable by visual inspection and, based on operating experience, the visual inspection and function test performed bi-monthly which detects degradation of the fire doors prior to loss of the intended function.

The applicant states, in the PNP LRA, that fire doors are periodically tested and visually inspected by qualified inspectors for signs of corrosion, wear, or missing parts to ensure that functionality and operability is maintained.

GALL AMP XI.M26 recommends at least bi-monthly visual inspection of hollow doors. The PNP LRA does not specify the frequency of inspection. During the audit the project team asked the applicant to clarify whether PNP uses the same inspection frequency, and if not, the applicant was asked to explain why and to add this to the program exceptions. The applicant responded that the PNP inspection interval for hollow metal fire doors is every six months. The inspection frequency has been every six months for many years, is considered satisfactory, and has not required a change due to not having a trend of significant aging of hollow metal fire doors. PNP Procedure FPSP-SO-2 lists each of the fire doors, inspection requirements, and acceptance criteria. The applicant has committed in the PNP LRA to revise inspection criteria and acceptance criteria for fire door clearances. The project team found this response acceptable since ISG-4, parameters monitored and inspected, states that hollow metal fire 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. Therefore, this is consistent with the ISG-4 recommendation. On this basis, the project team finds this enhancement acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

In addition, the applicant states, in the PNP LRA, that the enhancement in meeting the GALL Report elements is as follows:

Elements:	4: Detection of Aging Effects 5: Monitoring and Trending	(XI.M26 and XI.M27)
Enhancement:	Develop and implement procedures to perform visual inspections for fire door clearances.	

The GALL Report identifies the following recommendations for the detection of aging effects and monitoring and trending program elements associated with the third enhancement:

> Visual inspection (VT-3 or equivalent) detects any sign of degradation of the fire door such as wear and missing parts.
>
> Wear, missing parts, or holes in the fire door are detectable by visual inspection and, based on operating experience, the visual inspection and function test performed bi-monthly which detects degradation of the fire doors prior to loss of the intended function.

The applicant states, in the PNP LRA, that fire doors are tested and/or visually inspected by qualified inspectors semi-annually for signs of corrosion, wear, missing parts, and proper clearances to ensure that functionality and operability is maintained. The GALL Report recommends that fire door clearances are to be checked at least once bi-monthly. However, the PNP LRA does not specify frequency of inspection. The project team asked the applicant to clarify that the same frequency is used, and if not, to provide justification. In a letter dated August 25, 2005, the applicant states that per ISG-4 a plant-specific interval is allowable. The applicant also states that the PNP inspection interval for hollow metal fire doors is every six months. This frequency has been every six months for many years, is considered satisfactory, and has not required a change due to not having a trend of significant aging of hollow metal fire doors. PNP Procedure FPSP-SO-2 lists each of the fire doors, inspection requirements, and acceptance criteria. On the basis of the review of the applicant's response and since the applicant is revising the implementing procedures to be consistent with the GALL Report and ISG-4, the project team finds this enhancement after implementation to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

The applicant states, in the PNP LRA, that the enhancement in meeting the GALL Report elements is as follows:

Elements:	4: Detection of Aging Effects 5: Monitoring and Trending	(XI.M26)
Enhancement:	Revise diesel-driven fire pump performance test procedures to more specifically address the requirement to inspect and monitor the fuel oil supply line for aging related degradation, and to document inspection results.	

The GALL Report identifies the following recommendations for the detection of aging effects and monitoring and trending program elements associated with the fourth enhancement:

> 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.
>
> The performance of the fire pump is monitored during the periodic test to detect any degradation in the fuel supply lines. Periodic testing provides data (e.g., pressure) for trending necessary.

The applicant states, in the PNP LRA, that testing of the fire pumps is performed every 18 months to ensure that an adequate flow of fire water is supplied and that there is no degradation of the fuel line to the diesel-driven fire pump. The fire protection system pressure is continuously monitored. Test results from the various surveillance tests are evaluated. Periodic full flow flushing of the main fire system underground piping is performed to assure that corrosion is not occurring and the system function is maintained.

During the audit and review, the project team asked the applicant to provide details on the diesel driven fuel pump tests. In a letter dated August 25, 2005, the applicant states that, in the PNP LRA transmittal letter dated March 22, 2005, Attachment 2, Commitment 22, NMC made a commitment to, "Revise diesel-driven fire pump performance test procedures to more specifically address requirement to inspect and monitor fuel oil supply line for aging related degradation, and to document inspection results." As discussed in Appendix B of the PNP LRA, the applicant describes programs as if enhancements have been incorporated. The program, when enhancements are complete, will be consistent with the GALL Report. The applicant added that since its Fire Protection Program presently does not contain a specific inspection of the diesel driven fire pump fuel supply lines, there are no test results available for review.

During the audit and review, the project team noted that PNP AMP B2.1.10 states that Enhancement 4 "revises diesel-driven fire pump performance test procedures to more specifically address requirement to inspect and monitor fuel oil supply line for aging related degradation and to document inspection results." However, this enhancement does not indicate whether or not the revised procedures will be consistent with the GALL Report recommendations for the detection of aging effects and monitoring and trending program elements. In a letter dated August 25, 2005, the applicant states the following:

> LRA Section B2.1.10, Fire Protection Program, Detection of Aging Effects, second full paragraph on page B-77, is hereby revised to read as follows:
>
> Testing of the fire pumps (e.g., diesel-driven fire pump flow and discharge tests, sequential starting capability tests, and controller function tests) is performed every 18 months to ensure that an adequate flow of water is supplied and that there is no degradation of the fuel line to the diesel-driven fire pump.
>
> LRA Section B2.1.10, Fire Protection Program, Monitoring and Trending, third paragraph, is hereby revised to read as follows:
>
> Testing of the fire pumps is performed every 18 months to ensure that an adequate supply of water is supplied and that there is no degradation of the fuel line to the diesel driven fire pump. The performance tests detect degradation of the fuel supply lines before loss of the component intended function, and provide data (e.g., pressure) necessary for trending. The applicant added that these revised statements are consistent with the GALL paragraphs quoted in the question.

After implementation of this enhancement, this program element will be consistent with the GALL Report. On this basis, the project team finds this enhancement to be acceptable.

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

Element:	4: Detection of Aging Effects (XI.M27)
Enhancement:	Develop and implement procedures for inspection of below grade fire protection system piping. Inspections shall occur when below grade piping is excavated for maintenance, and shall include pipe wall thickness (NDE or direct measurement) and documentation of aging related degradation of pipes. Procedures shall include acceptance criteria, and criteria for further corrective actions if acceptance criteria are not met.

The GALL Report identifies the following recommendation for the detection of aging effects program element associated with the fifth enhancement:

> Internal inspections of aboveground fire protection piping and the smaller diameter fire suppression piping are performed on system components (when they are disassembled) to identify evidence of loss of material due to corrosion. Repair and replacement actions are initiated as necessary. Continuous system pressure monitoring, periodic system flow testing performed, and internal inspections of aboveground piping are effective means to ensure that corrosion and biofouling are not occurring and the system's intended function is maintained.

ISG-04 and GALL AMP XI.M27 identify the following recommendation for the detection of aging effects program element associated with the fifth enhancement:

> 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.

The applicant states, in the PNP LRA, that below grade fire protection system piping will be inspected for pipe wall thickness and age related degradation during inspections of opportunity when the below grade systems are excavated for maintenance.

During the audit and review, the project team noted that PNP LRA Table 3.3.2-7 lists “valves and dampers” in addition to “piping and fittings” as a component group with an external environment of soil. The project team asked the applicant to clarify why PNP LRA Table 3.3.2-7 lists “valves and dampers” and “piping and fittings” as component groups with a soil external environment. The applicant was asked to explain how the aging effects of loss of material and selective leaching (for buried cast iron piping) are managed by its Fire Protection Program for these components. In addition, similar to PNP AMP B2.1.5, “Buried Services Corrosion Monitoring Program,” the applicant was requested to provide the frequency of inspection of the buried components that are managed by its Fire Protection Program.

In a letter dated August 25, 2005, the applicant states that PNP LRA Table 3.3.2-7 for the fire protection system indicates that cast iron components in soil and raw water environments are managed for selective leaching by PNP AMP B2.1.13, “One-Time Inspection Program.” The applicant’s One-Time Inspection Program summarizes the application of the program to selective leaching. The applicant added that the buried “valves and dampers” and “piping and fittings” of the fire protection system are managed for corrosion and MIC by the Fire Protection Program. The Fire Protection Program discussion in PNP AMP B2.1.10, page B-77, summarizes the application of the program to below grade fire protection system components.

In regard to the inspection frequency of the buried components, the applicant states the following in a letter dated August 25, 2005:

> Prior to entering the extended period of operation, we will verify that there is at least one opportunistic or focused inspection performed within the last ten years. Visual inspections of a sample of buried carbon, low-alloy, and stainless steel components will be performed within ten years after entering the period of extended operation, unless opportunistic inspections have occurred within this ten-year period. Prior to the tenth year, NMC will perform an evaluation of available data to determine if sufficient inspections have been performed to assess the condition of the components. If insufficient data exists, focused inspection's will be performed as needed. Any credited inspection should be performed in areas with the highest likelihood of corrosion problems, and in areas with a history of corrosion problems.

The project team reviewed the applicant's response. The project team finds that after implementation of this enhancement, this program element will be consistent with the GALL Report. On this basis, the project team finds this enhancement to be acceptable.

In addition, the applicant states, in the PNP LRA, that the enhancement in meeting the GALL Report element is as follows:

> Element: 3: Parameters Monitored/Inspected (XI.M26 and XI.M27)
> Enhancement: Plant procedures shall be revised to more specifically address identification of aging related degradation and expectations for documentation of fire hydrant condition. Also, these revisions shall include provisions to perform flow testing for fire hydrants within the scope of license renewal that are credited for fire suppression in the PNP current licensing basis (CLB).

The GALL Report identifies the following recommendation for the parameters monitored/inspected program element associated with the sixth enhancement:

> The NRC GL 89-13 recommends periodic flow testing of infrequently used loops of the fire water system at the maximum design flow to ensure that the system maintains its intended function.

The applicant states, in the PNP LRA, that fire hydrants are flushed to test for flow restriction and proper hydrant operation and drainage. Hydrants are visually inspected for corrosion and damage, and proper thread/valve lubrication. Hydrants within the scope of license renewal that are credited for fire suppression in the PNP current licensing basis are flow tested.

GALL AMP XI.M27 lists nozzles, hydrant, hose stations, and standpipes as components whose aging effects are managed by this program. During the audit and review, the project team noted that PNP LRA Table 3.3.2-7 does not include any of these components as component groups subject to an AMR. The applicant clarified that these components are rolled up to "pipe and fittings" and "valves and dampers" in PNP LRA Table 3.3.2-7. The applicant added that PNP has no exceptions to the surveillance frequencies identified in GALL AMP XI.M27, as clarified by ISG-04. Fire hydrant flushes and verification of unrestricted flow are conducted annually. After implementation of this enhancement, this program element will be consistent with the GALL Report. On this basis, the project team finds this enhancement to be acceptable.

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

> Element: 4: Detection of Aging Effects (XI.M26 and XI.M27)
> Enhancement: Develop and implement procedures to replace all sprinkler heads prior to the end of the 50 year service life, or for testing of a representative sample of sprinkler heads prior to the end of the 50 year service life and at 10 year intervals thereafter, per requirements of NFPA 25, Section 5.3.

The GALL Report identifies the following recommendation for the detection of aging effects program element associated with the seventh enhancement:

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

ISG-04 identifies the following recommendation for the detection of aging effects program element associated with the seventh enhancement:

> 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 states, in the PNP LRA, that sprinkler heads will be replaced, or tested in accordance with NFPA 25, prior to exceeding their 50 year service life. The required testing will be repeated at ten year intervals. The project team finds that the enhancement to the applicant's Fire Protection Program will provide additional assurance that the effects of aging will be adequately managed, since it will be consistent with the ISG-04 recommendation for the sprinkler head inspections. After implementation of this enhancement, this program element will be consistent with the GALL Report. On this basis, the project team finds this enhancement acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

2.8.5 Operating Experience

The applicant states, in the PNP LRA, that PNP has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events and assesses these for applicability to its own operations. In addition, the PNP Corrective Action Program (CAP) is used to track, trend and evaluate plant issues/events. Those issues and events, whether external or plant-specific, that are potentially significant to fire protection at PNP are evaluated. The Fire Protection Program is augmented, as appropriate, if these evaluations show that program changes will enhance fire protection and operational safety.

The applicant states, in the PNP LRA, that using the OEP and CAP to focus on industry and plant operating experience ensures that Fire Protection Program issues are addressed in a timely manner and that age-related deterioration of SSCs within the scope of the Fire Protection Program will be effectively managed throughout the license renewal period.

The applicant also states, in the PNP LRA, that a review of industry operating experience associated with the Fire Protection Program and aging reveals issues and instances related to:

- Fire water system piping corrosion and ruptures
- Fire retardant coatings and materials
- Fouling of components in contact with raw water
- Problems with fire barriers

The applicant states, in the PNP LRA, that various related NRC and/or industry generic communications have been issued, and, in turn, have been incorporated into the program as applicable.

In addition, the applicant states, in the PNP LRA that a review of plant-specific operating experience related to the Fire Protection Program and aging revealed that the following issues have been addressed:

- Blockage of fire protection piping with corrosion products
- Deluge valve trim piping failures due to corrosion
- Underground fire main rupture due to cyclic loadings
- Water tight fire door seal degradation

Furthermore, the applicant states, in the PNP LRA, that the PNP Fire Protection Program has demonstrated that it provides reasonable assurance that aging effects are being managed for Fire Protection Program SSCs. This has been demonstrated through NRC inspection reports, audits, self-assessments, and the Corrective Action Program.

The project team reviewed the operating experience provided in the PNP LRA, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

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

2.8.6 FSAR Supplement

The applicant provides its FSAR Supplement for the Fire Protection Program in PNP LRA, Appendix A, Section A2.10, which states that the Fire Protection Program includes (a) fire barrier inspections, (b) electric and diesel-driven fire pump tests, and (c) periodic maintenance, testing, and inspection of water-based fire protection systems. Periodic visual inspections of fire barrier penetration seals, fire dampers, fire barrier walls, ceilings and floors, and periodic visual inspections and functional tests of fire-rated doors are performed to ensure that functionality and operability is maintained. Periodic testing of the fire pumps ensures that an adequate flow of firewater is supplied and that there is no degradation of diesel fuel supply lines. Periodic maintenance, testing and inspection activities of water-based fire protection systems provides reasonable assurance that fire water systems are capable of performing their intended function. Inspection and testing include periodic hydrant inspections, fire main flushing, sprinkler inspections, pipe wall thickness testing and flow tests.

The commitments for the PNP AMP B2.1.10 program enhancements are contained in the applicant's March 22, 2005 letter to the NRC.

The project team reviewed the FSAR Supplement and enhancement commitments for PNP AMP B2.1.10, found that they are consistent with the GALL Report, and determined that the FSAR Supplement 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).

2.8.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team finds that those program elements for which the applicant claims consistency with the GALL Report are consistent with the GALL Report and ISG-4. 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 those portions of the GALL Report AMP and ISG-4 to which it was compared. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

2.9 FLOW ACCELERATED CORROSION PROGRAM (PNP AMP B2.1.11)

In PNP LRA, Appendix B, Section B2.1.11, the applicant states that PNP AMP B2.1.11, "Flow Accelerated Corrosion Program," is an existing plant program that is consistent with GALL AMP XI.M17, "Flow Accelerated Corrosion."

2.9.1 Program Description

In the PNP LRA, the applicant states that this program is an existing program that manages aging effects due to flow-accelerated corrosion (FAC) on the internal surfaces of carbon or low alloy steel piping, elbows, reducers, expanders, and valve bodies which contain high energy fluids (both single phase and two phase). The program implements the EPRI guidelines in NSAC-202L-R2 for an effective FAC program and includes (a) an analysis using a predictive code such as CHECWORKS™ to determine critical locations, (b) baseline inspections to determine the extent of thinning at these locations, (c) follow-up inspections to confirm the predictions, and (d) repairing or replacing components, as necessary.

2.9.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B2.1.11 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 5 of this audit and review report for PNP AMP B2.1.11, including basis document, LR-AMPBD-15-FAC, "Flow Accelerated Corrosion Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M17.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B2.1.11 and associated basis documents against GALL AMP XI.M17 for consistency.

During the audit and review, the project team noted that the monitoring and trending program element as presented in the PNP LRA did not expressly commit to perform examinations in areas adjacent to locations where wall thickness was less than predicted. In the PNP LRA, the applicant commits to conform to NSAC-202L-R2, which specifies such examinations. The project team finds this program element to be consistent with the GALL Report and therefore acceptable.

The project team also noted that the acceptance criteria program element as presented in the PNP LRA did not confirm that the number of refueling or operating cycles remaining would be computed. In the PNP LRA, the applicant describes the use of the predictive computer code (CHECWORKS), which provides this information in the standard reports that it generates. During the audit and review, the project team noted that the applicant also identifies a minimum wall thickness acceptance criterion for Class 1 piping at 87.5% of nominal wall thickness. In a letter dated August 25, 2005, the applicant agrees to use the same value to trigger engineering analysis for non-safety-related piping. On this basis, the project team finds this to be consistent with the GALL Report and therefore acceptable.

The project team reviewed those portions of the Flow Accelerated Corrosion Program for which the applicant claims consistency with GALL AMP XI.M17 and finds that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's Flow Accelerated Corrosion Program provides reasonable assurance that aging effects attributable to FAC will be adequately managed during the period of extended operation. The project team finds the applicant's Flow Accelerated Corrosion Program acceptable because it conforms to the recommended GALL AMP XI.M17, "Flow Accelerated Corrosion."

2.9.3 Exceptions to the GALL Report

None

2.9.4 Enhancements

None

2.9.5 Operating Experience

The applicant states, in the PNP LRA, that PNP has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events and assesses these for applicability to its own operations. In addition, the PNP Corrective Action Program (CAP) is used to track, trend and evaluate plant issues/events. Those issues and events, whether external or plant-specific, that are potentially significant to the Flow Accelerated Corrosion Program at PNP are evaluated. The Flow Accelerated Corrosion Program is augmented, as appropriate, if these evaluations show that program changes will enhance program effectiveness.

The applicant also states, in the PNP LRA, that a review of industry operating experience associated with the Flow Accelerated Corrosion Program reveals issues and instances related to the following:

- Feedwater heater shell degradation and ruptures
- Feedwater and condensate line ruptures

- Pipe wall thinning downstream of control valves and flow restricting devices
- Valve body erosion
- Extraction steam line ruptures
- Moisture separator reheater drain tank drain line ruptures
- Steam generator feedwater distribution piping and J-tube damage
- Erosion of carbon steel ribs and tube supports in steam generators

The applicant states, in the PNP LRA, that various related NRC and/or industry generic communications have been issued, and, in turn, have been incorporated into the program as applicable.

In addition, the applicant states, in the PNP LRA that a review of plant-specific operating experience related to the Flow Accelerated Corrosion Program and aging revealed that the following issues have been addressed:

- FAC on two-inch main steam line elbows
- Higher than expected wear rates on eight-inch steam pipes and elbows on the outlet of moisture separator reheater
- Main condenser tube leaks caused by FAC
- Higher than expected wear rates on high pressure extraction steam piping to high pressure feedwater heater
- FAC on end-bell of low pressure feedwater heater
- Valve body FAC on control valves and check valves
- FAC of feedwater heater shell side capped drains
- FAC damage to low pressure turbine extraction sleeves
- FAC damage to extraction steam lines to high pressure feedwater heaters
- FAC damage to moisture separator reheater vent line
- FAC of feedwater piping
- FAC of reducer downstream of control valve
- Through wall steam leak on steam generator flash tank

In addition, the applicant states that NRC inspection reports, audits, self-assessments, and its corrective action program were reviewed for relevant information and no findings were identified that would indicate that the program is ineffective. Some identified weaknesses have resulted in corrective actions and program enhancements.

The project team reviewed the applicant’s Flow Accelerated Corrosion (FAC) Master Plan to confirm that operating experience documented in the applicant’s OEP and CAP reports had been incorporated into implementing procedures. The applicant's technical staff was also interviewed to confirm that the plant-specific operating experience was bounded by industry experience. The project team finds that the existing program has been effective in identifying, monitoring, and correcting the effects of FAC and can be expected to ensure that piping wall thickness is maintained above the minimum required by design.

On the basis of its review of industry and plant-specific operating experience and discussions with the applicant's technical staff, the project team concludes that the applicant’s Flow

Accelerated Corrosion Program will continue to adequately manage the aging effects that are identified in the PNP LRA for which this AMP is credited.

2.9.6 FSAR Supplement

The applicant provides its FSAR Supplement for the Flow Accelerated Corrosion Program in PNP LRA, Appendix A, Section A2.11, which states that the Flow Accelerated Corrosion Program manages aging effects due to FAC on the internal surfaces of carbon or low-alloy steel piping, elbows, reducers, expanders, and valve bodies which contain high energy fluids (both single phase and two phase). The program implements the EPRI guidelines in NSAC-202L-R2 for an effective FAC program and includes (a) an analysis using a predictive code such as CHECWORKS™ to determine critical locations, (b) baseline inspections to determine the extent of thinning at these locations, (c) follow-up inspections to confirm the predictions, and (d) repairing or replacing components, as necessary.

The project team reviewed the FSAR Supplement for PNP AMP B2.1.11, 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).

2.9.7 Conclusion

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

On the basis of its review of the FSAR Supplement for this program, the project team finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

2.10 NON-EQ ELECTRICAL COMMODITIES CONDITION MONITORING PROGRAM (PNP AMP B2.1.12)

In PNP LRA, Appendix B, Section B2.1.12, the applicant states that PNP AMP B2.1.12, “Non-EQ Electrical Commodities Condition Monitoring Program,” is a new plant program that is consistent with GALL AMP XI.E1, “Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements,” GALL AMP XI.E2, “Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits,” and GALL AMP XI.E3, “Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements,” and guidance provided in ISG-2 and draft ISGs-5, 15, 17 and 18.

2.10.1 Program Description

The applicant states, in the PNP LRA, that this program manages aging in selected non-EQ commodity groups within the scope of 10 CFR 54. Program activities are responsive to the NRC guidance provided in the GALL Report and industry standards.

The applicant also states, in the PNP LRA, that PNP has identified each electrical commodity group requiring aging management for the three applicable sections of the GALL Report with the additional guidance provided in ISG-2 and draft ISGs-5, 15, 17 and 18, as follows:

C GALL AMP XI.E1, “Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements,” requires a periodic inspection program that visually inspects accessible cables and connections in adverse localized environments with any identified degradation being evaluated and, as appropriate per plant procedures, entered into the plant corrective action process. The Non-EQ Electrical Commodities Condition Monitoring Program predominantly inspects for adverse aging from temperature, radiation, or moisture in the presence of oxygen.

Electrical pinned connectors are subject to pin corrosion from boric acid leakage, and periodic inspections are conducted in the Boric Acid Corrosion Program to preclude failures resulting from leakage.

The non-segregated bus within the scope of license renewal was conservatively assessed, as discussed in draft ISG-17, to require aging management. The “weak link” in maintaining a non-aging environment was identified to be unchecked water leakage through the housing seals and bus bar connections due to thermal cycling. Appropriate inspection activities are included in the periodic inspections.

C GALL AMP XI.E2, “Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits,” requires routine calibration tests to be performed to identify potential existence of aging degradation of cables and connections used in low-level signal applications that are sensitive to reduction in insulation resistance (IR) such as radiation monitoring and nuclear instrumentation. This is revised as discussed in draft ISG-15 which allows testing once every 10 years in lieu of TS surveillance test trending. The Non-EQ Electrical Commodities Condition Monitoring Program does subject sensitive instrumentation circuits, identified as requiring aging management, to periodic testing.

C GALL AMP XI.E3, “Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements,” requires a periodic test to provide an indication of the condition of the conductor insulation for those cables within the scope of license renewal exposed to long periods of high moisture (greater than a few days at a time) and subjected to voltage stress (energized greater than 25% of the time). Periodic testing will be performed on these medium voltage cables to provide an indication of the insulation condition. The Non-EQ Electrical Commodities Condition Monitoring Program includes input from draft ISG-18 for periodic inspections of underground raceway manholes for the accumulation of water over the medium-voltage cables. Periodic inspections of underground manholes for the accumulation of water in the medium-voltage cable manholes will minimize the effects of water inside the underground manholes.

The fuse holders that were not inside active equipment were evaluated per draft ISG-5 and determined to have no aging effect that required management.

2.10.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B2.1.12 is consistent with GALL AMP XI.E1, GALL AMP XI.E2, and 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 PNP AMP B2.1.12, including basis document, LR-AMPPDB-17-NONEQELECOM, “Non-EQ Electrical Commodities Condition Monitoring Program,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.E1, GALL AMP XI.E2, and GALL AMP XI.E3.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B2.1.12 and associated basis documents against GALL AMP XI.E1, GALL AMP XI.E2, and GALL AMP XI.E3 for consistency.

The scope of GALL AMP XI.E1 includes 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. During the audit and review, the project team noted that the scope of the PNP AMP is different in that it includes only low-voltage cables and connections including low-voltage pin connectors. It does not include other cables and connections such as medium voltage cables. The project team requested that the applicant explain how the accessible medium voltage cables aging will be managed and why low-voltage cable electrical pinned connectors are identified as a separate item. The applicant responded that all cables are part of a spatial cable commodity. The applicant informed the project team that it committed to expand the scope of PNP AMP B2.1.12 to include all cables and connections within the scope of license renewal that are installed in adverse localized environments. The project team finds the applicant’s response acceptable because the scope of program is now consistent with the scope of GALL AMP XI.E1. In a letter dated August 25, 2005, the applicant revises the PNP LRA to expand the scope of PNP AMP B2.1.12 to include all cables and connections.

GALL AMP XI.E1 defines an adverse localized environment as a condition in a limited plan area that is significantly more severe than the specified service environment for the cable. The PNP AMP defines a localized adverse environment as when any electrical insulation material is exposed to an aging environment that is significantly greater than the bounding design parameter value. The definition of adverse localized is inconsistent with the definition in the GALL program. The project team requested that the applicant explain what is the difference between significantly greater than the bounding design parameter value and significantly more severe than the specified service environment for the cable. In a letter dated August 25, 2005, the applicant states that the bounding design parameter has the same meaning as the specified service environment. The terms are used interchangeably. The project team finds the response acceptable because it provides clarification of the definitions between the GALL program and the PNP AMP.

The applicant credits its 10 CFR 50, Appendix B, “Quality Assurance Program,” for the corrective actions program element. However, this program does not address the special requirements identified in GALL AMP XI.E1. GALL AMP XI.E1 specifically requires that all unacceptable visual inspections of cable and connection jacket surface anomalies are subject to an engineering evaluation. Such an evaluation is to consider the age and operating environment of the component, as well as the severity of the anomaly and whether such an anomaly has previously been correlated to degradation of conductor insulation or connections. Corrective actions may include, but are not limited to, testing, shielding or otherwise changing the environment, or relocation or replacement of the affected cable or connection. When an unacceptable condition or situation is identified, a determination is made as to whether the same condition or situation is applicable to other accessible or inaccessible cables or connections. The project team requested that the applicant address these specific requirements. The applicant informed the project team that it committed to revise PNP AMP B2.1.12 to address the specific requirements as described above. The project team finds the applicant's response acceptable because the corrective action elements will be consistent with the GALL Report program element. In a letter dated August 25, 2005, the applicant adds these specific requirements in PNP AMP B2.1.12 under the corrective actions program element.

The testing frequency in GALL AMP XI.E2, under the detection of aging effects program element, is different than the test frequency as proposed in PNP AMP B2.1.12. GALL AMP XI.E2 states that the test frequency of these cables shall be determined by the applicant based on an engineering evaluation but the test frequency shall not exceed ten years. PNP AMP states that a 10-year frequency is an adequate period to identify cables and connection degradation to preclude excessive leakage currents since experience has shown that aging degradation is a slow process. The test frequency should be determined by an engineering evaluation based on the test results The project team questioned the applicant on the basis of the 10-year test frequency. In response to the project team's request, the applicant informed the project team that it committed to revise PNP AMP B2.1.12 to state that test frequency of these cables shall be determined by the applicant based on an engineering evaluation, but shall not exceed 10 years. The project team finds this response acceptable because the proposed test frequency is now consistent with GALL AMP XI.E2. In a letter dated August 25, 2005, the applicant revises the PNP AMP B2.1.12 to include this change.

GALL AMP XI.E2 states that all cables within the scope of this program will be tested. PNP AMP states that cables used in nuclear instrumentation circuits are to be tested and if an unacceptable condition or situation is identified, a determination shall be made as to applicability of the conditions on other cables used in the nuclear instrumentation circuits. It was not clear to the project team whether only some within scope nuclear instrumentation cables will be tested or all cables within the scope of the program will be tested. The project team asked the applicant to clarify this inconsistency. In response to the project team's request, the applicant informed the project team that it committed to revise the PNP AMP to include all sensitive cables and connections within the scope of license renewal are to be tested and delete the sentence "and if an unacceptable condition or situation is identified, a determination shall be made as to applicability of the condition on other cables used in the nuclear instrumentation circuits" to avoid confusion. In a letter dated August 25, 2005, the applicant revises PNP AMP B2.1.12 to include this change.

In Section B1.2, "Quality Assurance Program and Administrative Controls," of the PNP LRA, the applicant credits the PNP Quality Program for the corrective actions program element. However, this program does not address the special requirements identified in GALL AMP XI.E2. GALL AMP XI.E2 specifically recommends that an engineering evaluation be performed when the test acceptance criteria are not met. This is to ensure that the intended functions of the electrical cable system can be maintained consistent with the current licensing basis. Such an evaluation is to consider the significance of the test results, the operability of the component, the reportability of the event, the extend of the concern, the potential root cause for meeting the test acceptance criteria, and the likelihood of recurrence. During the audit and review, the project team requested that the applicant address these specific requirements in PNP AMP B2.1.12. The applicant clarified that it addresses the above requirements in the PNP AMP under corrective actions. The project team finds the applicant's response acceptable because the corrective actions program element is consistent with GALL AMP XI.E2. In a letter dated August 25, 2005, the applicant revises PNP AMP B2.1.12 to include this change.

The typical type of tests in PNP AMP B2.1.12 are different than the tests in the GALL Report. GALL AMP XI.E3, under the parameters monitored/inspected program element, states that a specific type of test performed will be determined prior to the initial test performed, and is to be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, 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 PNP AMP states that identified within the scope of license renewal inaccessible medium-voltage insulated cables subject to long periods of high moisture conditions and voltage stress are tested (such as insulation resistance tests, time domain reflectometry tests (TDR), or other tests effective in determining cable insulation conditions. The project team noted that insulation resistance and TRD are identified as the types of tests used in GALL AMP XI.E2 for low voltage sensitive instrumentation cables. The project team requested that the applicant provide the basis for insulation resistance or TDR used for inaccessible medium-voltage cables. The applicant responded that GALL AMP XI.E3 references EPRI TR-103834-P1-2 which discussed insulation resistance test and TRD. However, the applicant informed the project team that it committed to revise the test methods to be consistent with GALL AMP XI.E3. The project team finds the applicant's response acceptable because the test methods to be performed for detecting deterioration of insulated system for inaccessible medium voltage are the same as GALL AMP XI.E3. In a letter dated August 25, 2005, the applicant revises PNP AMP B2.1.12 to include this change.

GALL AMP XI.E3, under the detection of aging effects program element, states that inspection interval for water collection should be performed based on actual file data. However, the inspection frequency should not exceed two years. The PNP AMP states that periodic inspections (periodicity will be based on inspection results) of underground manholes, for the accumulation of water levels will be conducted. The applicant's AMP does not specify the maximum inspection duration for water collection. The project team requested the applicant to provide manhole inspection frequency of inspection. The applicant informed the team that it committed to revise the PNP LRA to state that periodicity will based on inspection results, but not to exceed two years. The project team finds the applicant's response acceptable because the inspection interval for water collection in manholes is consistent with the GALL Report. In a letter dated August 25, 2005, the applicant revises PNP AMP B2.1.12 to include this change.

GALL AMP XI.E3 requires all within the scope of the program, medium-voltage cables exposed to significant voltage and moisture be tested. PNP AMP states that if an unacceptable condition or situation is identified, a determination would be made as to whether the same condition or situation is applicable to other inaccessible within the scope of the program, medium-voltage cables. It was not clear to the project team that whether all cables within the scope of the program be tested or just a sample of cables will be tested. The project team requested the applicant to confirm that all cables within the scope of the program will be tested and pointed out the confusion this sentence created. In response to the project team's request, the applicant informed the project team that it will remove the last sentence of the first paragraph in PNP AMP B2.1.12 to clearly state that all within the scope of the program cables will be tested. The project team finds the applicant's response acceptable because it will eliminate the confusion created by the above sentence. In a letter dated August 25, 2005, the applicant revises PNP AMP B2.1.12 to include these changes.

In Section B1.2 of the PNP LRA, the applicant credits 10 CFR Part 50, Appendix B, "Quality Assurance" for the corrective actions program element. However, GALL AMP XI.E3 corrective actions require specific actions such as an engineering evaluation is performed when the test acceptance criteria are not met in order to ensure that the intended function of the electrical system can be maintained consistent with the current licensing basis. Such an evaluation is to consider the significance of the test results, the operability of the component, the reportability of the event, the extend of the concern, the potential root cause for not meeting the test acceptance criteria, the corrective actions required, and the likelihood of recurrence. The project team requested that the applicant address these specific requirements in its AMP under the correction action program element. The applicant informed the project team that it committed to revise PNP AMP B2.1.12 under corrective actions to add the above requirements. In a letter dated August 25, 2005, the applicant revises PNP AMP B2.1.12 to include these changes.

Interim Staff Guidance (ISG)-17 (Proposed GALL AMP XI.E4) states that a sample of bolted connections of metal enclosed bus will be checked for a loose connection by using thermography or by measuring connection resistance using a low range ohmmeter. This program also inspects the internal portion of the metal enclosed buses for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of water insulation. The bus insulating system will be inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. The (internal) bus support will be inspected for structural integrity and signs of cracks. This program will be completed before the end of the initial 40-year license term and every 10 years thereafter. PNP AMP states that the periodic inspection shall also include inspection for signs of water leakage or contamination into non-segregated bus through the housing seals and signs of localized heating potentially from loose internal electrical connections that may lead to electrical failure. It fails to address inspection of all structural/component of metal enclosed bus such as external bus enclosure, internal bus enclosure, internal bus support, and bus insulating systems. The project team requested that the applicant explain how cracking, corrosion, foreign debris, etc., will be identified without internal inspections, how aging effects of internal bus support and insulating system of metal enclosed bus will be managed, and how loose connections will be identified. The applicant informed the project team that it committed to revise PNP AMP B2.1.12, page B-91, to state that periodic inspections shall also include visual inspections for signs of water leakage or contamination into the non-segregated bus through the housing seals and signs of localized heating potentially from loose internal electrical connections that may lead to electrical failure. This program will also provide for the inspection of the internal portion of the bus ducts for cracks, corrosion, foreign debris, excessive dust buildup, and evidence of water intrusion. The bus insulating system will be inspected for signs of 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. A representative sample of the bus connections will be inspected using thermography. The program will be completed before the end of the 40-year license term and every 10 years thereafter. The project team finds the applicant's response acceptable because it conforms to the ISG-17. In a letter dated August 25, 2005, the applicant revises PNP AMP B2.1.12 to include these changes.

ISG-17 under the preventive action element states that this is an inspection program and no actions are taken as part of this program to prevent or mitigate aging degradation. No information was provided under this element in PNP AMP B2.1.12. The project team requested that the applicant include this element. The applicant informed the project team that it committed to revise PNP AMP B2.1.12, Page B-90 under preventive actions to be consistent with ISG-17. The project team finds the applicant's response acceptable because it is consistent with the program element described in ISG-17. In a letter dated August 25, 2005, the applicant revises PNP AMP B2.1.12 to include this element.

The project team reviewed those portions of the Non-EQ Electrical Commodities Condition Monitoring Program for which the applicant claims consistency with GALL AMP XI.E1, GALL AMP XI.E2, and GALL AMP XI.E3 and finds that they are consistent with the GALL AMPs. Furthermore, the project team concludes that the applicant's Non-EQ Electrical Commodities Condition Monitoring Program provides reasonable assurance that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB during the period of extended operation as required by 10 CFR 54.21(a)(3). The project team finds the applicant's Non-EQ Electrical Commodities Condition Monitoring Program acceptable because it conforms to the recommended GALL AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," GALL AMP XI.E2, "Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits," and GALL AMP XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," and ISG-17, "Proposed Aging Management Program XI.E4; Periodic Inspection of Bus Ducts," for license renewal.

2.10.3 Exceptions to the GALL Report

None

2.10.4 Enhancements

The applicant states, in the PNP LRA, that a Non-EQ Electrical Commodities Condition Monitoring Program will be developed and implemented. Features of the program will include development and implementation of procedures to conduct periodic inspection of insulated cables and connectors, test sensitive instrumentation circuits, test medium voltage cables, and inspect manhole water levels.

In addition, the applicant states that the program element descriptions describe the program as it will be implemented. The program will be implemented prior to the period of extended operation.

The project team finds this enhancement acceptable, since PNP committed to develop PNP AMP B2.1.12, "Non-EQ Electrical Commodities Condition Monitoring Program," to include procedures for conducting periodic inspection of insulated cables and connectors, test sensitive instrumentation circuits, test medium voltage cables, and inspect manhole water levels. This is consistent with GALL AMP XI.E1, “Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements,” GALL AMP XI.E2, “Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits,” and GALL AMP XI.E3, “Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements,” and guidance provided in ISG-2 and draft ISGs-5, 15, 17 and 18.

2.10.5 Operating Experience

The applicant states, in the PNP LRA, that PNP has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events and assesses these for applicability to its own operations. In addition, the PNP Corrective Action Program (CAP) is used to track, trend and evaluate plant issues/events. Those issues and events, whether external or plant-specific, that are potentially significant to the Non-EQ Electrical Commodities Condition Monitoring Program at PNP are evaluated. The Non-EQ Electrical Commodities Condition Monitoring Program is augmented, as appropriate, if these evaluations show that program changes will enhance program effectiveness.

The applicant states, in the PNP LRA, that using the OEP and CAP to focus on industry and plant operating experience ensures that Non-EQ Electrical Commodities Condition Monitoring Program issues are addressed in a timely manner and that age related deterioration of commodities within the scope of the Non-EQ Electrical Commodities Condition Monitoring Program will be effectively managed throughout the license renewal period.

The applicant also states, in the PNP LRA, that industry experience, as documented in SAND96-0344, “Aging Management Guideline for Commercial Nuclear Plants - Electrical Cables and Terminations”, has shown three main causes of cable and connection failures well before a nominal 40 or 60-year service life:

- Cables routed/installed in abnormal configurations, outside the prescribed or normal design guidelines and installation design criteria, may fail due to being exposed to temperatures well above the expected normal ambient temperature. PVC insulated cable insulation failures are the most common cable insulation failures to occur due to high temperature and/or radiation environments.

- Sensitive instrumentation cable insulations (nuclear instrumentation and radiation monitoring) have less tolerance for “loss of material properties” that adversely affect the circuit signals.

- Medium voltage power cable failures occur because of water-treeing (moisture and voltage stress).

In addition, the applicant states, in the PNP LRA, that site-specific experience has shown that existing routine switchyard inspections detect loose connections in the switchyard. Existing periodic and routine switchyard inspections preclude failures of connections in the switchyard.

The applicant also states, in the PNP LRA, that abnormal plant configurations at PNP were found to produce localized adverse environments in some specific cases. A corrective action document identified signs of cable jacket damage from improper design/installation that led to a localized adverse environment for the cables. In addition, LER 84-10 resulted from improper design and installation outside expected normal cable configurations. The Corrective Action Program corrected both plant configurations to eliminate the identified localized adverse temperature environments.

In addition, the applicant states, in the PNP LRA, that a medium-voltage cable failure has occurred at PNP from the possible effects of water-treeing. LER 96-002 did demonstrate that this commodity group warrants periodic testing to preclude or minimize future failures. PNP has also experienced that the underground manholes for the medium-voltage cables within the scope of license renewal have experienced moisture for periods greater than a few days at a time.

The applicant states, in the PNP LRA, that one cable commodity-related assessment was conducted to address overloaded cable trays. This analysis calculated power cable ohmic heating temperatures in those overloaded tray sections and compared it against the respective cable temperature rating to ensure that proper operating conditions exist and are maintained. The results of this analysis were considered when reviewing the plant's electrical cables and connections, and were addressed when assessing and identifying those cables requiring aging management during the extended period of operation.

Furthermore, the applicant states, in the PNP LRA, that since its Non-EQ Electrical Commodities Condition Monitoring Program is a new program, no NRC inspection reports, audits, self assessments, or program-specific corrective actions are available.

The project team reviewed the operating experience provided in the PNP LRA, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

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

The project team recognizes that the applicant's 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.

2.10.6 FSAR Supplement

The applicant provides its FSAR Supplement for the Non-EQ Electrical Commodities Condition Monitoring Program in PNP LRA, Appendix A, Section A2.12, which states that the Non-EQ Electrical Commodities Condition Monitoring Program manages aging in selected non-EQ commodity groups within the scope of 10 CFR 54. Features of the program consist of periodic inspection of insulated cables and connectors, testing of sensitive instrumentation circuits, testing of medium voltage cables, and inspection of manholes for the presence of water.

The commitment for the enhancement to develop PNP AMP B2.1.12 is contained in the applicant's March 22, 2005 letter to the NRC.

The project team reviewed the FSAR Supplement and enhancement commitment for PNP AMP B2.1.12, found that they are consistent with the GALL Report, and determined that the FSAR Supplement 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).

2.10.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report, ISG-2 and draft ISGs-5, 15, 17 and 18. 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 AMP being consistent with the GALL Report AMP, ISG-2, and draft ISGs-5, 15, 17 and 18 to which it was compared. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

2.11 ONE-TIME INSPECTION PROGRAM (PNP AMP B2.1.13)

In PNP LRA, Appendix B, Section B2.1.13, the applicant states that PNP AMP B2.1.13, "One-Time Inspection Program," is a new plant program that is consistent with GALL AMP XI.M32, "One-Time Inspection," with an exception. The applicant also states that PNP AMP B2.1.13, "One-Time Inspection Program" is consistent with GALL AMP XI.M33, "Selective Leaching of Materials," and portion of GALL AMP XI.M29, "Above Ground Carbon Steel Tanks" that are associated with the thickness measurement of tank bottom surfaces.

2.11.1 Program Description

The applicant states, in the PNP LRA, that this program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching. It provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. Hence, the One-Time Inspection Program provides methods for verifying an aging management program is not needed, verifying the effectiveness of an existing program, or determining that degradation is occurring which will require evaluation and corrective action.

The applicant also states, in the PNP LRA, that the program includes (a) determination of appropriate inspection sample size, (b) identification of inspection locations, (c) selection of examination techniques with acceptance criteria, and (d) evaluation of results to determine the need for additional inspections or other corrective actions. The inspection sample includes locations where the most severe aging effect(s) would be expected to occur. Inspection methods may include visual (or remote visual), surface or volumetric examinations, or other established non-destructive evaluation (NDE) techniques.

This program is used for a variety of purposes, including but not limited to the following:

- To verify the effectiveness of water chemistry control for managing the effects of aging in stagnant or low-flow portions of piping exposed to a treated water environment.

- To manage the aging effects of loss of material due to aging mechanisms such as general, crevice, pitting, and galvanic corrosion; selective leaching; and microbiologically influenced corrosion (MIC).

- To verify that cracking due to stress corrosion cracking or cyclic loading, in small bore (< 4" nominal pipe size [NPS]) ASME Class 1 piping, is not occurring.

- To verify, for components in the compressed air system, that there are no aging effects requiring management in the dry air environment.

The following PNP AMPs credit the One-Time Inspection Program:

- Closed Cycle Cooling Water Program
- Water Chemistry Program
- Fire Protection Program
- System Monitoring Program

2.11.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B2.1.13 is consistent with GALL AMP XI.M32, with an exception. The applicant also states that PNP AMP B2.1.13 is consistent with GALL AMP XI.M33 and portion of GALL AMP XI.M29 that are associated with the thickness measurement of tank bottom surfaces.

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 PNP AMP B2.1.13, including program basis document LR-AMPBD-21-ONETIME, “One-Time Inspection Program” which provides an assessment of the AMP elements' consistency with GALL AMP XI.M29, GALL AMP XI.M32, and GALL AMP XI.M33.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B2.1.13 and associated basis documents against GALL AMP XI.M29, GALL AMP XI.M32, and GALL AMP XI.M33 for consistency.

During the audit and review, the project team noted that the description of inspection and testing activities for the detection of aging effects program element of this PNP AMP to be insufficient. In a letter dated July 1, 2005, the applicant provides a table clarifying which methods would be used to detect each of the aging effects managed by the One-Time Inspection Program, including those related to detection of selective leaching and the monitoring loss of material from the bottom of above-ground carbon steel tanks. Because the methods listed in the response provided in the July 1, 2005 letter monitor parameters directly related to the degradation of a component, the project team finds the program to be consistent with the GALL Report and therefore is acceptable.

The project team's review of PNP LRA Section B2.1.13 identified an area in which additional information was necessary to complete the review of the applicant's AMR review results. The applicant responded to the project team's RAI as discussed below.

RAI-3.1.2-1. AMPs that note "one-time inspections" should identify an acceptable form of inspection method for various types of situations. The PNP LRA does not identify any specific methods of inspection. The PNP LRA simply provides a general statement that examination techniques will be visual, volumetric, or other appropriately established NDE methods. Please identify the inspection methods for each "one time inspection" listed.

In its response, dated July 1, 2005, the applicant states that specific methods of inspection for individual components will be identified as part of implementation procedure development. The applicant will begin working on implementation later this year and has plans to complete draft AMPs and implementing procedures in 2006. The One-Time Inspection Program will be included in this effort. It is expected that PNP's one-time inspection methods will be generally in accordance with the table provided in the GALL Report, Rev. 1, Vol. 2, as follows:

Examples of Parameters Monitored or Inspected and Aging Effect for Specific Structure or Component

Aging Effect	Aging Mechanism	Parameter Monitored	Inspection Method
Loss of Material	Crevice Corrosion	Wall Thickness	Visual (VT-1) and/or Volumetric (RT or UT)
Loss of Material	Galvanic Corrosion	Wall Thickness	Visual (VT-3) and/or Volumetric (RT or UT)
Loss of Material	General Corrosion	Wall Thickness	Visual (VT-3) and/or Volumetric (RT or UT)
Loss of Material	MIC	Wall Thickness	Visual (VT-3) and/or Volumetric (RT or UT)
Loss of Material	Pitting corrosion	Wall Thickness	Visual (VT-1) and/or Volumetric (RT or UT)
Loss of Material	Selective Leaching	Wall Thickness	Hardness Test
Loss of Material	Erosion	Wall Thickness	Visual (VT-3) and/or Volumetric (RT or UT)
Loss of Heat Transfer	Fouling	Tube Fouling	Visual (VT-3) or remote visual

Aging Effect	Aging Mechanism	Parameter Monitored	Inspection Method
Cracking	SCC, thermal stratification and turbulent penetration	Cracks	Volumetric (RT or UT)
Loss of preload	Stress Relaxation	Various	Visual (VT-3)

Based on the above discussion, the project team finds the applicant's response to RAI-3.1.2-1 is acceptable because the project team finds the program to be consistent with the GALL Report. The project team's concern described in RAI-3.1.2-1 is resolved.

The project team reviewed portions of the One-Time Inspection Program that the applicant claims to be consistent with GALL AMP XI.M29, GALL AMP XI.M32, and GALL AMP XI.M33 and finds that they are consistent with the GALL Report AMPs. Furthermore, the project team concludes that the applicant's One-Time Inspection Program provides reasonable assurance that aging effects are either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. The project team finds the applicant's One-Time Inspection Program acceptable because in addition to being consistent with GALL AMP XI.M29 and GALL AMP XI.M33, it is consistent with the recommended GALL AMP XI.M32, "One-Time Inspection," with one exception that is evaluated in Section 2.11.3, below.

2.11.3 Exceptions to the GALL Report

In the PNP LRA the applicant notes an exception to the GALL Report.

> Element 4: Detection of Aging Effects
> Exception: The current state of technology does not provide for an effective, reliable method of performing volumetric examinations of small bore socket welds. The combination of these one-time volumetric examinations of a 10% sample of Class 1 butt welds, 4" NPS and smaller, and the 100% VT-2 examinations of all Class 1 and 2 HSS socket welds 2" NPS and under each refueling outage meets the intent of the SRP-LR and the GALL Report to provide aging management for small-bore Class 1 piping.

The GALL Report identifies the following recommendation for the "detection of aging effects" program element associated with the exception taken:

> For small-bore piping less than NPS 4 inches, including pipe, fittings, and branch connections, a plant-specific destructive examination of replaced piping due to plant modifications or NDE that permits inspection of the inside surfaces of the piping is to be conducted to ensure that cracking has not occurred.

GALL AMP XI.M32, "One-Time Inspection," recommends plant-specific destructive examination of replaced piping due to plant modifications, or NDE that will detect cracking on the inside surfaces of the small bore piping. The applicant states, in the PNP LRA, that the current state of technology does not provide for an effective, reliable method of performing volumetric examinations of small bore socket welds. The project team evaluated the combination of these one-time volumetric examinations of a 10% sample of Class 1 butt welds, NPS 4" and smaller, and the 100% VT-2 examinations of all Class 1 and 2 high safety significance socket welds NPS 2" and under during each refueling outage. The project team determines that this provides a sufficient sample size to provide adequate management for aging of small-bore Class 1 piping. On this basis, the project team finds the exception to be acceptable.

2.11.4 Enhancements

The applicant states, in the PNP LRA, that the One-Time Inspection Program will be developed and implemented. Features of the program will include:

- Controlling procedure and implementing documents for activities associated with the program. This procedure will include a listing of all SSCs that credit this program for aging management, the aging effects and mechanisms being managed, the materials and environments for the SSCs, grouping and inspection sampling techniques to be used, identification of inspection locations, acceptance criteria, inspection scope expansion criteria, and required actions for inspection results that fall outside acceptance criteria. Inspection results and evaluation of results should be documented, and records retrievable for the life of the plant.

- Controls to ensure that at least 10% of all Class 1 butt welds less than 4” NPS receive a volumetric examination prior to the end of, and within the last 5 years of, the current operating period, with the welds to be inspected chosen from the population of Class 1 HSS butt welds from the RI-ISI Program. In addition, ensure that 100% of all Class 1 and 2 HSS socket welds 2” NPS and under receive a VT-2 visual inspection each refueling outage.

In addition, the applicant states that the element descriptions describe the program as it will exist after it has been implemented. The program is scheduled to be implemented prior to the period of extended operation.

The project team finds this acceptable, since PNP committed to develop PNP AMP B2.1.13, “One-Time Inspection Program,” to include controlling procedure and implementing documents for activities associated with the program. This procedure will include a listing of all SSCs that credit this program for aging management, the aging effects and mechanisms being managed, the materials and environments for the SSCs, grouping and inspection sampling techniques to be used, identification of inspection locations, acceptance criteria, inspection scope expansion criteria, and required actions for inspection results that fall outside acceptance criteria. Inspection results and evaluation of results should be documented, and records retrievable for the life of the plant. PNP also committed to develop PNP AMP B2.1.13, “One-Time Inspection Program,” to include controls to ensure that at least 10% of all Class 1 butt welds less than 4” NPS receive a volumetric examination prior to the end of, and within the last 5 years of, the current operating period, with the welds to be inspected chosen from the population of Class 1 HSS butt welds from the RI-ISI Program. In addition, ensure that 100% of all Class 1 and 2 HSS socket welds 2” NPS and under receive a VT-2 visual inspection each refueling outage. This is consistent with GALL AMP XI.M32, “One-Time Inspection,” and GALL AMP XI.M33, “Selective

Leaching of Materials,” and the portions of GALL AMP XI.M29, “Above Ground Carbon Steel Tanks” that are associated with the thickness measurement of tank bottom surfaces.

2.11.5 Operating Experience

The applicant states, in the PNP LRA, that PNP has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events and assesses these for applicability to its own operations. In addition, the PNP Corrective Action Program (CAP) is used to track, trend and evaluate plant issues/events. Those issues and events, whether external or plant-specific, that are potentially significant to the One-Time Inspection Program at PNP are evaluated.

The applicant also states, in the PNP LRA, that the One-Time Inspection Program is a new program to be implemented before the current operating license expires. The NDE inspection methods that will be used, such as hardness testing, visual (or remote visual), surface or volumetric, or other established techniques, are consistent with industry practice.

In addition, the applicant states, in the PNP LRA, that using the OEP and CAP to focus on industry and plant operating experience ensures that its One-Time Inspection Program issues will be addressed in a timely manner and that age-related deterioration of SSCs within the scope of the One-Time Inspection Program will be effectively managed.

The project team reviewed the operating experience provided in the PNP LRA, and interviewed the applicant's technical staff. This review confirmed that the plant-specific operating experience revealed no degradation beyond the bounds of industry experience. On this basis, the project team finds that one-time inspection is an acceptable method for confirming that existing programs adequately manage potential aging effects.

The project team recognizes that the applicant’s corrective action program, which captures internal and external plant operating experience issues, will ensure that operating experience is reviewed and appropriate changes to aging management programs continue to be incorporated. On the basis of its review of industry and plant-specific operating experience and discussions with the applicant's technical staff, the project team concludes that the applicant’s One-Time Inspection Program will adequately manage the aging effects that are identified in the PNP LRA for which this AMP is credited.

2.11.6 FSAR Supplement

The applicant provides its FSAR Supplement for the One-Time Inspection Program in PNP LRA, Appendix A, Section A2.13, which states that the One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. Hence, the One-Time Inspection Program provides measures for verifying an AMP is not needed, verifying the effectiveness of an existing program, or determining that degradation is occurring which will require evaluation and corrective action.

The applicant also states, in the PNP LRA, that the program includes (a) determination of appropriate inspection sample size, (b) identification of inspection locations, (c) selection of examination techniques, with acceptance criteria, and (d) evaluation of results to determine the need for additional inspections or other corrective actions. The inspection sample includes locations where the most severe aging effect(s) would be expected to occur. Inspection methods may include visual (or remote visual), surface or volumetric examinations, or other established NDE techniques.

Additionally, the applicant states, in the PNP LRA that this program is used for a variety of purposes, including the following:

C To verify the effectiveness of water chemistry control for managing the effects of aging in stagnant or low-flow portions of piping or components, exposed to a treated water environment.

C To manage the aging effects of loss of material due to aging mechanisms such as general, crevice, pitting, and galvanic corrosion; selective leaching; and MIC.

C To verify that cracking due to stress corrosion cracking or cyclic loading, in small bore (< 4" NPS) ASME Class 1 piping, is not occurring.

C To verify, for components in the compressed air system, that there are no aging effects requiring management in the dry air environment.

The project team reviewed the FSAR supplement for PNP AMP B2.1.13. Since this aging management program is credited with managing aging effects that may reduce the thickness of above-ground carbon steel tank bottoms, the project team considers it appropriate to include this in the FSAR summary statement. In a letter dated July 1, 2005, the applicant states that the FSAR summary for its One-Time Inspection Program will be modified to include reference to the aging management of above-ground carbon steel tank bottoms. The project team finds this to be consistent with the GALL Report and therefore acceptable.

The commitment for the enhancement to develop PNP AMP B2.1.13 is contained in the applicant’s March 22, 2005 letter to the NRC.

The project team reviewed the FSAR Supplement and enhancement commitment for PNP AMP B2.1.13, found that they are consistent with the GALL Report, and determined that the FSAR Supplement 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).

2.11.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. 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 AMP being consistent with the GALL Report AMP to which it was compared. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

The commitment for the enhancement to develop PNP AMP B2.1.13 is contained in the applicant's March 22, 2005 letter to the NRC.

The project team reviewed the FSAR Supplement and enhancement commitment for PNP AMP B2.1.13, found that they are consistent with the GALL Report, and determined that the FSAR Supplement 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).

2.12 OPEN CYCLE COOLING WATER PROGRAM (PNP AMP B2.1.14)

In PNP LRA, Appendix B, Section B2.1.14, the applicant states that PNP AMP B2.1.14, "Open Cycle Cooling Water Program," is an existing plant program that is consistent with GALL AMP XI.M20, "Open-Cycle Cooling Water System."

2.12.1 Program Description

The applicant states, in the PNP LRA, that this is an existing program that manages aging effects such as loss of material due to general, pitting, and crevice corrosion, erosion, MIC, and loss of heat transfer due to biological/corrosion product fouling (e.g., sedimentation, silting) caused by exposure of internal surfaces of metallic components to raw, untreated (e.g., service) water. The program scope includes activities to manage aging in the service water system (SWS) and circulating water system (CWS). The aging effects are managed through (a) monitoring and control of biofouling, (b) flow balancing and flushing, (c) heat exchanger testing (d) routine inspection and maintenance program activities to ensure that aging effects do not impair component intended function. Inspection methods include visual examination (VT), ultrasonic testing (UT), radiographic testing (RT), and eddy current testing (ECT). This program is responsive to NRC GL 89-13, "Service Water System Problems Affecting Safety-Related Equipment".

The applicant also states, in the PNP LRA, that biofouling monitoring is accomplished by having the service water pump intake bay inspected each refueling outage by divers for biofouling species. Periodic maintenance activities for the inspection of safety-related heat exchangers include steps to take samples for analysis and inspection for biofouling species and microbiologically influenced corrosion (MIC). Biofouling control is accomplished by chlorinating the SWS and CWS to mitigate the effects of biological fouling. Chemical concentration conforms to the requirements set by the Michigan Department of Environmental Quality in PNP's national pollutant discharge elimination system.

In addition, the applicant states, in the PNP LRA, that to verify that components receive FSAR required flows, the SWS is balanced each refueling outage as per plant procedures. The performance of this test assures that flows set during testing meet the requirements set by the plant's FSAR for a design basis accident. The testing also fulfills the recommended actions that other components be tested once per refueling outage to assure that components are not fouled or clogged. The actions to periodically flush piping and flow balance the SWS fulfill the recommendation suggested by control technique 2 of GL 89-13 to assure that fouling sediment is flushed from piping.

The applicant states, in the PNP LRA, that the heat exchanger testing program main goals are to establish a framework to assess plant heat exchanger condition:

- To select heat exchangers requiring immediate attention and apply realistic plugging criteria.
- To identify problems and perform repairs where necessary to maintain the integrity of heat exchangers.
- To establish a sound basis for heat exchanger inspection intervals.
- To apply effective non-destructive evaluation (NDE) and testing
- To utilize a database management program to acquire, analyze, trend, and store data.
- To plan heat exchanger replacement.

Furthermore, the applicant states, in the PNP LRA, that PNP has established a routine inspection and maintenance monitoring program for service water piping and components to ensure that corrosion, erosion, silting, and biofouling cannot degrade the performance of the safety related systems supplied by service water to where they are unable to perform their intended functions. This program has the following objectives:

- To remove excessive accumulations of biofouling agents, corrosion products, and silt.
- To repair defective protective coatings and corroded piping and components that could adversely affect performance of their intended safety functions.

2.12.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B2.1.14 is consistent with GALL AMP XI.M20.

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 PNP AMP B2.1.14, including basis document, LR-AMPBD-19-OCCW, “Open Cycle Cooling Water Program,” which provides an assessment of the consistency of the PNP AMP elements with respect to GALL AMP XI.M20.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B2.1.14 and associated basis documents against GALL AMP XI.M20 for consistency.

During the audit and review, the project team noted that the current program element of scope of program described in the PNP LRA does not contain commitments for two of the guidelines contained in GL-89-13. The guidelines of GL-89-13 are incorporated in GALL AMP XI.M20. The specific components of the GL 89-13 program that are missing from PNP AMP B2.1.14 are a system walkdown inspection to ensure compliance with the licensing basis and a review of maintenance, operating, and training practices and procedures. In technical discussions with the applicant during the audit and review, the applicant indicated that PNP does in fact perform activities during maintenance activities that result in meeting these two components of the GALL AMP XI.M20. The applicant stated that it would revise the PNP LRA to include these two programmatic items. In a letter dated August 25, 2005, the applicant states that the original statements in the scope of program discussion for PNP AMP B2.1.14 concerning implementation of recommendations (d) and (e) of GALL AMP XI.M20 were not correct. These activities are included in existing plant procedures as part of the ongoing management of aging, and are not an exception to the GALL Report. With this revision, the PNP AMP is consistent with the GALL AMP. The project team finds this response acceptable.

The project team reviewed those portions of the applicant's Open Cycle Cooling Water Program for which the applicant claims consistency with GALL AMP XI.M20 and finds that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's Open Cycle Cooling Water Program provides reasonable assurance that aging effects attributable to open cycle cooling water will be adequately managed during the period of extended operation. The project team finds the applicant's Open Cycle Cooling Water Program acceptable because it conforms to the recommended GALL AMP XI.M20, "Open-Cycle Cooling Water System."

2.12.3 Exceptions to the GALL Report

None

2.12.4 Enhancements

None

2.12.5 Operating Experience

The applicant states, in the PNP LRA, that PNP has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events, and assesses these for applicability to its own operations. In addition, the PNP Corrective Action Program (CAP) is used to track, trend and evaluate plant issues/events. Those issues and events, whether external or plant-specific, that are potentially significant to the Open Cycle Cooling Water Program at PNP are evaluated. The Open Cycle Cooling Water Program is augmented, as appropriate, if these evaluations show that program changes will enhance program effectiveness.

The applicant states, in the PNP LRA, that a review of industry operating experience associated with its Open Cycle Cooling Water Program and aging reveals issues and instances related to the following:

- Accumulations of silt and corrosion products in service water piping, valves, and heat exchangers
- Accumulation of biological growth (mussels, clams, and shells) in service water piping, valves and heat exchangers
- MIC causing pitting attack of carbon steel and stainless steel service water piping, pump casings, and 90/10 Cu/Ni heat exchanger tubes

The applicant also states, in the PNP LRA, that a review of plant-specific operating experience related to the Open Cycle Cooling Water Program and aging revealed that the following issues have been addressed:

- Defective tubes in the main condenser that required plugging due to MIC
- Control room condensing unit condenser drain plug severely corroded due to MIC
- Large zebra mussel accumulation near traveling screens and inside intake piping
- Blockage of heat exchanger and cooler tubing
- Corroded service water piping at threaded connections
- Pinhole leaks in service water piping due to MIC
- Switch failure due to sediment and corrosion (galvanic) blocking sensing line
- Tubercles growing in carbon steel service water piping
- Erosion of pipes, cooling coils, and heat exchanger tubes causing service water leaks

In addition, the applicant states, in the PNP LRA, that using the OEP and CAP to focus on industry and plant operating experience ensures that Open Cycle Cooling Water Program issues are addressed in a timely manner and that age-related deterioration of SSCs within the scope of the Open Cycle Cooling Water Program will be effectively managed throughout the license renewal period.

Furthermore, the applicant states, in the PNP LRA, that the Open Cycle Cooling Water Program has demonstrated on several occasions that it provides reasonable assurance that aging effects are being managed for Open Cycle Cooling Water Program SSC. This has been demonstrated through NRC inspection reports, audits, self-assessments, and the Corrective Action Program.

The project team reviewed a sample of the operating experience documents and noted that, as part of the corrective actions, program and system upgrades have been implemented. These include new system and component flushes, procedure changes, and new non-destructive examination testing. There was no indication in the documents reviewed that the intended function of any system components was lost before detection and corrective action taken. Based on this review, the project team finds that the program has been effective in managing the aging effects. This was augmented by a review of recent system health reports for the service water system and circulating water and cooling towers system. The system health reports did not indicate any issues. This review supported the conclusion that the applicant's program is effective in managing the aging effects for which this AMP is credited.

The project team reviewed the operating experience provided in the PNP LRA, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

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

2.12.6 FSAR Supplement

The applicant provides its FSAR Supplement for the Open Cycle Cooling Water Program in PNP LRA, Appendix A, Section A2.14, which states that the Open Cycle Cooling Water Program manages aging effects such as loss of material due to general, pitting, and crevice corrosion, erosion, MIC, and loss of heat transfer due to biological/corrosion product fouling (e.g., sedimentation, silting) caused by exposure of internal surfaces of metallic components to raw, untreated (e.g., service) water. The program scope includes activities to manage aging in the SWS and CWS. The aging effects are managed through (a) monitoring and control of biofouling, (b) flow balancing and flushing, (c) heat exchanger testing, and (d) routine inspection and maintenance program activities to ensure that aging effects do not impair component intended function. Inspection methods include VT, UT, RT, and ETC. This program is responsive to NRC GL 89-13.

The current program described in the application does not contain commitments for two of the GL 89-13 guidelines contained in the FSAR Supplement table for this AMP. The specific components of the GL 89-13 program that are missing are a system walkdown inspection to ensure compliance with the licensing basis and a review of maintenance, operating, and training practices and procedures. In a letter dated August 25, 2005, the applicant revises the PNP LRA to add these statements to the scope of program description for this AMP.

The project team reviewed the FSAR Supplement for PNP AMP B2.1.14, found that it was consistent with the GALL Report with the changes identified in the August 25, 2005 letter 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).

2.12.7 Conclusion

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

On the basis of its review of the FSAR Supplement for this program, the project team finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

2.13 OVERHEAD LOAD HANDLING SYSTEMS INSPECTION PROGRAM (PNP AMP B2.1.15)

In PNP LRA, Appendix B, Section B2.1.15, the applicant states that PNP AMP B2.1.15, “Overhead Load Handling Systems Inspection Program,” is an existing plant program that is consistent with GALL AMP XI.M23, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling System,” with an exception and an enhancement.

2.13.1 Program Description

The applicant states, in the PNP LRA, that this program is an existing program that provides for inspections of the structural components and rails of cranes and fuel handling machines associated with heavy load handling that are subject to the requirements of NUREG-0612 and are within the scope of license renewal requiring aging management. For PNP these are the containment building polar crane, the spent fuel pool overhead crane, the containment building jib and boom cranes, and the reactor and spent fuel pool fuel handling machines. These cranes comply with the maintenance rule requirements provided in 10 CFR 50.65. The Overhead Load Handling Systems Inspections Program is primarily focused on structural components that make up the bridge and trolley of the overhead cranes that are within the scope of NUREG-0612.

2.13.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B2.1.15 is consistent with GALL AMP XI.M23, with an exception and 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 PNP AMP B2.1.15, including basis document, LR-AMPBD-20-OVHDLOAD, "Overhead Load Handling System Inspection Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M23.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B2.1.15 and associated basis documents against GALL AMP XI.M23 for consistency.

The project team reviewed those portions of the Overhead Load Handling Systems Inspection Program for which the applicant claims consistency with GALL AMP XI.M23 and finds that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's Overhead Load Handling Systems Inspection Program provides reasonable assurance that the structural components and rails of the cranes within the scope of license renewal are capable of sustaining their rated loads for the period of extended operation. The project team finds the applicant's Overhead Load Handling Systems Inspection Program acceptable because it conforms to the recommended GALL AMP XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems," with the exceptions and enhancements as described below.

2.13.3 Exceptions to the GALL Report

The applicant states, in the PNP LRA, that the exception to the GALL Report element is as follows:

> Element: 3: Parameters Monitored/Inspected
> Exception: PNP does not track the number and magnitude of all lifts made by cranes. Administrative controls are implemented to ensure that only allowable loads are handled and fatigue failure of structural elements is not expected.

The GALL Report identifies the following recommendation for the "parameters monitored/inspected" program element associated with the exception taken:

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

The applicant states, in the PNP LRA, that PNP does not track the number and magnitude of all lifts made by cranes. Administrative controls are implemented to ensure that only allowable loads are handled and fatigue failure of structural elements is not expected. A time-limited aging analysis report (PNP LRA Section 4.7.1) concludes that, at the current service level, there are no fatigue concerns for the containment polar crane and the spent fuel pool crane as both the containment polar and spent fuel pool crane cannot realistically approach the 20,000 to 100,000 rated lifts assumed for its design evaluation during the extended operating period. Frequent inspections of cranes for indications of functional failures are conducted. However, PNP does track the number and magnitude of lifts made that exceed the rated capacity of the cranes. These are called “engineered lifts,” follow the requirements of ANSI B30.2, and are generally only used for the polar crane lifting the reactor head with lead shielding. These lifts are numerically restricted, and evaluated by engineering analysis.

The project team finds the applicant’s explanation for the exception acceptable in that review of the number and magnitude of crane lifts is not necessary since the cranes within the scope of license renewal are infrequently used and the allowable limits are expected to provide adequate margin for the period of extended operation. The applicant addressed the number of crane lifts as a TLAA in PNP LRA Section 4.7.1. A qualitative review of the number and magnitude of lifts made by a crane is reasonable since the recording of the number and magnitude of every crane lift below design capacity would be an excessive documentation burden for cranes where their utilization is well below their design life. However, the applicant does track the number and magnitude of lifts made by the license renewal cranes that exceed their rated capacity. These greater than rated capacity lifts are designated engineered lifts with the number performed restricted and prior evaluation by engineering analysis performed. The project team reviewed operating experience for the polar crane where the reactor vessel head with lead shielding was removed using engineered lifts during several refueling outages. The weight of the vessel head and shielding exceeded the rated capacity of the polar crane. The project team found the number and magnitude of the polar crane engineered lifts to be well documented. On the basis of the evaluation of the data in PNP LRA Section 4.7.1, the infrequent use service level of the cranes, and its review of operating experience for the Overhead Load Handling Systems Inspection Program (see Section 2.13.5, below), the project team finds this exception to be acceptable.

2.13.4 Enhancements

The applicant states, in the PNP LRA, that the enhancement in meeting the GALL Report elements as follows:

Elements:	1: Scope of Program 4: Detection of Aging Effects 6: Acceptance Criteria
Enhancement:	Revise crane and fuel handling machine inspection procedures to specifically inspect for general corrosion on passive components making up the bridge, trolley, girders, etc., and to inspect rails of bridge cranes for wear. The revision should also include

documentation of the results of these inspections, acceptance criteria, and qualification requirements for inspectors and crane supervisors. The applicant states in the PNP LRA that the enhancement is scheduled for completion prior to the period of extended operation.

The GALL Report identifies the following recommendations for the “scope of program,” “detection of aging effects,” and “acceptance criteria” program elements associated with the enhancement:

> The program manages the effects of general corrosion on the crane and trolley structural components for those cranes that are within the scope of 10 CFR 54.4, and the effects of wear on the rails in the rail system.
>
> Crane rails and structural components are visually inspected on a routine basis for degradation. Functional tests are also performed to assure their integrity.
>
> Any significant visual indication of loss of material due to corrosion or wear are evaluated according to applicable industry standards and good industry practice. The crane may also have been designed to a specific Service Class as defined in the EOCI Specification #61 (or later revisions), or CMAA Specification #70 (or later revisions), or CMAA Specification #74 (or later revisions). The specification that was applicable at the time the crane was manufactured is used.

The applicant states, in the PNP LRA, that this enhancement will add specific inspection steps for general corrosion and loss of material due to wear to the inspection procedures for cranes within the scope of license renewal. In addition, the applicant states that the inspection procedures will be revised to provide a method to document the results of these inspections, define acceptance criteria in accordance with applicable industry standards and good industry practice, and provide qualification requirements for inspectors and crane supervisors.

The project team finds that adding visual inspections for passive components making up the bridge, trolley, girders, etc., and requirements to inspect rails of bridge cranes for wear to the procedures will be adequate to ensure that loss of material is detected before there is a loss of intended function. In addition, the project team finds that revising the inspection procedures to evaluate significant indications for acceptance against applicable industry standards and good practice is consistent with the recommendations in GALL AMP XI.M23. On the basis that implementing these specific inspection steps will bring the applicant’s program into agreement with GALL AMP XI.M23, the project team finds this enhancement to be acceptable as such changes to the applicant’s program will provide additional assurance that the effects of aging will be adequately managed.

2.13.5 <u>Operating Experience</u>

The applicant states, in the PNP LRA, that PNP has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events and assesses these for applicability to its own operations. In addition, the PNP Corrective Action Program (CAP) is used to track, trend and evaluate plant issues/events. Those issues and events, whether external or plant-specific, that are potentially significant to the Overhead Load Handling Systems Inspection Program at

PNP are evaluated. The Overhead Load Handling Systems Inspection Program is augmented, as appropriate, if these evaluations show that program changes will enhance program effectiveness.

The applicant also states, in the PNP LRA, that using the OEP and CAP to focus on industry and plant operating experience ensures that Overhead Load Handling Systems Inspection Program issues are addressed in a timely manner and that age related deterioration of SSC within the scope of the Overhead Load Handling Systems Inspection Program will be effectively managed throughout the license renewal period.

The applicant states, in the PNP LRA, that a review of industry operating experience associated with the Overhead Load Handling Systems Inspection Program revealed no issues and instances related to aging.

In addition, the applicant states, in the PNP LRA that a review of plant specific operating experience related to the Overhead Load Handling Systems Inspection Program and aging revealed that the following issues have been addressed:

- Damage to spent fuel handling machine hoist cable
- Movement identified on containment hatch crane's base structure
- Containment crane rail attachment bolt grout pads cracked
- Load limit of containment crane exceeded during head lift
- Containment crane bridge rail splice weld cracks

Furthermore, the applicant states, in the PNP LRA, that the PNP Overhead Load Handling Systems Inspection Program has demonstrated that it provides reasonable assurance that aging effects are being managed for the Overhead Load Handling Systems Inspection Program SSCs. However, no recent external or internal audits/assessments have been conducted on this program.

The project team reviewed PNP corrective action condition reports related to the Overhead Load Handling Systems Inspection Program. The project team finds that there have been no failures from loss of material of structural components for cranes within the scope of license renewal. Any deficiencies associated with the license renewal cranes have been attributed to construction practices or general wear of active components. The project team also reviewed condition reports and engineering assistance requests, listed in Attachment 5 of this audit and review report, associated with performing engineered lifts by the containment polar crane. The project team finds the number and magnitude of the polar crane engineered lifts to be well documented and in accordance with applicable industry standards.

The project team reviewed the operating experience provided in the PNP LRA, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical staff, the project team concludes that the applicant’s Overhead Load Handling Systems Inspection Program will adequately manage the aging effects that are identified in PNP LRA for which this AMP is credited.

2.13.6 FSAR Supplement

The applicant provides its FSAR Supplement for the Overhead Load Handling Systems Inspection Program in PNP LRA, Appendix A, Section A2.15, which states that the Overhead Load Handling Systems Inspection Program provides for inspections of the structural components and rails of cranes and fuel handling machines associated with heavy load handling that are subject to the requirements of NUREG-0612, “Control of Heavy Loads at Nuclear Power Plants,” and are within the scope of license renewal requiring aging management. For PNP, these are the containment building polar crane, the spent fuel pool overhead crane, the containment building jib and boom cranes, and the reactor and spent fuel pool fuel handling machines. These cranes comply with the Maintenance Rule requirements provided in 10 CFR 50.65. The Overhead Load Handling Systems Inspections Program is primarily focused on structural components that make up the bridge and trolley of the overhead cranes that are within the scope of NUREG-0612. The applicant has committed to enhancing the program prior to the period of extended operation.

The commitments for PNP AMP B2.1.15 program enhancement is contained in NMC’s March 22, 2005 letter to the NRC.

The project team reviewed the FSAR supplement and enhancement commitments for PNP AMP B2.1.15, found that they are 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).

2.13.7 Conclusion

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

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

2.14 REACTOR VESSEL INTERNALS INSPECTION PROGRAM (PNP AMP B2.1.17)

In PNP LRA, Appendix B, Section B2.1.17, the applicant states that PNP AMP B2.1.17, “Reactor Vessel Internals Inspection Program,” is an existing plant program that, with enhancements, is consistent with GALL AMP XI.M16, “PWR Vessel Internals.”

2.14.1 Program Description

In the PNP LRA, the applicant states that this program currently manages the aging effects for reactor vessel internals (RVI). The program provides for (a) inservice inspection (ISI) in accordance with ASME Section XI requirements, including examinations performed during the 10-year ISI examination; (b) participation in industry initiatives to evaluate the significance of void swelling; (c) monitoring and control of reactor coolant water chemistry in accordance with the EPRI guidelines in TR-105714 (see the Water Chemistry Program) to mitigate stress corrosion cracking (SCC) or irradiation-assisted stress corrosion cracking (IASCC); and (d) participation in industry initiatives that will generate additional data on aging mechanisms relevant to RVI and develop appropriate inspection techniques to permit detection and characterization of features of interest.

The applicant also states that void swelling is an aging mechanism for reactor vessel internal components that has the potential to cause reduction in fracture toughness, and changes in dimensions. After its evaluation, the applicant does not consider void swelling to be a factor in the evaluation of reduction in fracture toughness at PNP. However, the applicant states that the potential significance of void swelling will be assessed through monitoring industry operating experience and EPRI research. If judged to be significant, evaluations of the need for augmented examinations for the effects of void swelling will be performed, and the results will be reported to the NRC at least two years prior to the end of the current operating license.

2.14.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B2.1.17 is consistent with GALL AMP XI.M16, 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 PNP AMP B2.1.17, including basis document, LR-AMPBD-23-VSLINTERNALS, “Reactor Vessel Internals Inspection Program,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.M16.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B2.1.17 and associated basis documents against GALL AMP XI.M16 for consistency. The project team noted that the applicant did not identify, as an exception, the difference between the edition of the ASME Code referenced in the PNP LRA and the one cited in the GALL AMP.

In a letter dated August 25, 2005, the applicant commits to revise the ASME Section XI IWB, IWC, IWD, IWF aging management program descriptions in PNP LRA Appendices A and B to reflect the 2001 Edition including the 2002 and 2003 Addenda of ASME Section XI. The revised program descriptions will identify exceptions to this code taken by the programs, if any, that impact aging management effectiveness. Appropriate justification will also be provided to show that the exceptions, if any, still provide an acceptable level of aging management. The project team finds this to be an acceptable component of the program for aging management of reactor vessel internals. **[This is Open Item OI-2.2.2-1.]**

During the audit and review, the project team requested additional information that would reflect all augmented examinations and enhanced inspection techniques, as appropriate.

In a letter dated August 25, 2005, the applicant commits to participate in industry initiatives that will generate additional data on aging mechanisms relevant to RVI, including void swelling, and develop appropriate inspection techniques to permit detection and characterization of features of interest. The applicant states that recommendations for augmented inspections and techniques resulting from this effort will be incorporated into its Reactor Vessel Internals Program as applicable. The revised Reactor Vessel Internals Program will be submitted for NRC review and approval by March 24, 2009. On this basis, the project team finds this to be acceptable.

The applicant also states, in the PNP LRA, that the ASME Section XI ISI Program is currently following ASME Section XI as required by 10 CFR 50.55a. However, GALL AMP XI.M16, “PWR Vessel Internals,” references the 1995 Edition through the 1996 Addenda. The ASME Section XI ISI Program will be updated to later editions and addenda as required by 10 CFR 50.55a; the code edition and addenda will not necessarily be those referenced by this revision of the GALL Report.

In a letter dated August 25, 2005, the applicant commits to revise the descriptions of its ASME Section XI IWB, IWC, IWD, IWF Program in PNP LRA Appendices A and B to reflect the 2001 Edition including the 2002 and 2003 Addenda of ASME Section XI. The revised program descriptions will identify exceptions to this code taken by the programs, if any, that impact aging management effectiveness. Appropriate justification will also be provided to show that the exceptions, if any, still provide an acceptable level of aging management.

The project team finds this to be an acceptable component of the program for aging management of reactor vessel internals.

The project team reviewed all other portions of the Reactor Vessel Internals Inspection Program for which the applicant claims consistency with GALL AMP XI.M16 and finds that they are consistent with the GALL Report AMP. **Predicated on satisfactory resolution of OI-2.2.2-1**, the project team finds the applicant’s commitment to submit a revised Reactor Vessel Internals Inspection Program acceptable.

2.14.3 Exceptions to the GALL Report

None

2.14.4 Enhancements

The applicant states, in the PNP LRA, that the enhancements in meeting the GALL Report elements as follows:

Elements:	1: Scope of Program 4: Detection of Aging Effects
Enhancements:	PNP will participate in the industry initiatives to evaluate the effect of Changes in Dimensions due to Void Swelling, and will report to the NRC at least two years prior to the end of the current

operating license the results of the industry initiative and a schedule for augmented inspections that will be required, if any.

PNP will participate in industry initiatives that will generate additional data on aging mechanisms relevant to RVI and develop appropriate inspection techniques to permit detection and characterization of features of interest. PNP will incorporate any recommended augmented inspections as appropriate.

The GALL Report identifies the following recommendations for the scope of program and detection of aging effects program elements associated with the enhancements

> The program is focused on managing the effects of crack initiation and growth due to SCC or IASCC, and loss of fracture toughness due to neutron irradiation embrittlement or void swelling. The program contains preventive measures to mitigate SCC 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. Loss of fracture toughness is of consequence only if cracks exist. Cracking is expected to initiate at the surface and is detectable by augmented inspection.
>
> The program provides guidelines to assure safety function integrity of the subject safety-related reactor pressure vessel internal components, both non-bolted and bolted components. The program consists of the following elements: (a) identify the most susceptible or limiting items, (b) develop appropriate inspection techniques to permit detection and characterizing of the feature (cracks) of interest and demonstrate the effectiveness of the proposed technique, and (c) implement the inspection during the license renewal term. For example, appropriate inspection techniques may include enhancing visual VT-1 examinations for non-bolted components and demonstrated acceptable inspection methods for bolted components.
>
> The extent and schedule of the inspection and test techniques prescribed by the aging management program are designed to maintain structural integrity and ensure that aging effects will be discovered and repaired before the loss of intended function. Inspection can reveal crack initiation and growth. Vessel internal components are inspected in accordance with the requirements of ASME Section XI, Subsection IWB, examination category B-N-3 for all accessible surfaces of reactor core support structures that can be removed from the vessel. The ASME Section XI inspection 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.
>
> However, visual VT-3 examination is to be augmented to detect tight or fine cracks. Also, historically the VT-3 examinations have not identified bolt cracking because cracking occurs at the juncture of the bolt head and shank, which is not

accessible for visual inspection. Creviced and other inaccessible regions are difficult to inspect visually. This AMP recommends more stringent inspections such as enhanced visual VT-1 examinations or ultrasonic methods of volumetric inspection, for certain selected components and locations.

The inspection technique is capable of detecting the critical flaw size with adequate margin. The critical flaw size is determined based on the service loading condition and service-degraded material properties. For non-bolted components, augmented ISI may include enhancement of the visual VT-1 examination of Section XI IWA-2210. A description of such an enhanced visual VT-1 examination should include the ability to achieve a 0.0005-inch resolution, with the conditions (e.g., lighting and surface cleanliness) of the inservice examination bounded by those used to demonstrate the resolution of the inspection technique. For bolted components, augmented ISI is to include other demonstrated acceptable inspection methods to detect cracks between the bolt head and the shank. Alternatively, the applicant may perform a component-specific evaluation, including a mechanical loading assessment to determine the maximum tensile loading on the component during ASME Code Level A, B, C, and D conditions. If the loading is compressive or low enough (< 5 ksi) to preclude fracture, then supplemental inspection of the component is not required. Failure to meet this criterion requires continued use of the augmented inspection methods.

After its evaluation, the applicant does not consider void swelling to be a factor in the evaluation of reduction in fracture toughness at PNP. However, the applicant states that the potential significance of void swelling will be assessed through monitoring industry operating experience and EPRI research. If judged to be significant, evaluations of the need for augmented examinations for the effects of void swelling will be performed, and the results will be reported to the NRC at least two years prior to the end of the current operating license.

The project team requested an additional commitment to revise the RVI Inspection Program to reflect all augmented examinations and enhanced inspection techniques that are appropriate. The revised program is to be submitted to the NRC staff by a date that will allow review and approval of the program prior to the period of extended operation.

In a letter dated August 25, 2005, the applicant commits to participate in industry initiatives that will generate additional data on aging mechanisms relevant to reactor vessel internals (RVI), including void swelling, and develop appropriate inspection techniques to permit detection and characterization of features of interest. Recommendations for augmented inspections and techniques resulting from this effort will be incorporated into the Reactor Vessel Internals Program as applicable. The revised Reactor Vessel Internals Program will be submitted for NRC review and approval by March 24, 2009.

Predicated on satisfactory resolution of OI-2.2.2-1, the project team accepts the applicant's commitment to submit a revised Reactor Vessel Internals Inspection Program for NRC review and approval by March 24, 2009.

In the PNP LRA, the applicant states that on the basis of operating experience at Combustion Engineering pressurized water reactors (PWRs) and component-specific evaluation by the

NSSS vendor, augmented inspections of the baffle-former bolting is not necessary because the most likely mechanism for the cracking of baffle former bolts in foreign plants is IASCC of cold-worked 316 stainless steel. In addition, the preload and operating stresses imposed by the design of plants where this aging mechanism has been observed is significantly higher than at PNP.

The project team reviewed the basis documents for the applicant's Reactor Vessel Internals Inspection Program and vendor evaluations of the stresses imposed on the PNP baffle-former bolts. These documents state that the baffle-former bolts are made of annealed 316 stainless steel that is not cold-worked. The documents also show that the bolt stress from preload is much less than in plants where failure has been observed, the differential pressure across the core shroud panels does not result in additional tensile loads on the bolts during normal operation, and the core shroud panel design transmits less load to the fasteners. On this basis, the project team concludes that, **predicated on satisfactory resolution of OI-2.2.2-1**, the applicant's Reactor Vessel Internals Inspection Program will adequately manage cracking of baffle-former bolting without augmented inspections.

2.14.5 Operating Experience

The applicant states, in the PNP LRA, that PNP has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events and assesses these for applicability to its own operations. In addition, the PNP Corrective Action Program (CAP) is used to track, trend and evaluate plant issues/events. Those issues and events, whether external or plant-specific, that are potentially significant to the Reactor Vessel Internals Inspection Program at PNP are evaluated. The Reactor Vessel Internals Inspection Program is augmented, as appropriate, if these evaluations show that program changes will enhance program effectiveness.

The applicant also states that a review of the industry operating experience related to the Reactor Vessel Internals Inspection Program revealed several instances where degradation has occurred within the reactor vessel internals. The review considered a variety of issues related to reactor internals which included degradation of baffle former bolts, barrel former bolts, guide bar bolts, core support shield to core barrel bolts, guide funnels, guide tube support pins, and rod cluster control assemblies.

Furthermore, the applicant's review of plant-specific operating experience revealed two instances where the Reactor Vessel Internals Inspection Program has been instrumental in discovering material degradation. Degradation was discovered in the core barrel and control rod drive mechanism (CRDM) seal housings.

The project team reviewed the operating experience provided in the PNP LRA, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience revealed no degradation beyond industry experience. **Predicated on satisfactory resolution of OI-2.2.2-1**, the project team accepts the applicant's commitment to submit a revised Reactor Vessel Internals Inspection Program for NRC review and approval by March 24, 2007.

2.14.6 FSAR Supplement

The applicant provides its FSAR Supplement for the Reactor Vessel Internals Inspection Program in PNP LRA, Appendix A, Section A2.17, which states that the Reactor Vessel

Internals Inspection Program manages the aging effects for reactor vessel internals. The program provides for (a) inservice inspection (ISI) in accordance with ASME Section XI requirements, including examinations performed during the 10-year ISI examination; (b) participation in industry initiatives to evaluate the significance of void swelling; (c) monitoring and control of reactor coolant water chemistry in accordance with the EPRI guidelines in TR-105714 to mitigate SCC or IASCC; and (d) participation in industry initiatives that will generate additional data on aging mechanisms relevant to RVI and develop appropriate inspection techniques to permit detection and characterization of features of interest. In addition, by a letter dated August 25, 2005, the applicant has agreed to submit the revised Reactor Vessel Internals Program to the NRC, by March 24, 2009, for review and approval.

The commitments for PNP AMP B2.1.17 program enhancement is contained in the applicant's March 22, 2005 letter to the NRC.

The project team reviewed the FSAR supplement and enhancement commitment for PNP AMP B2.1.17, found that they are consistent with the GALL Report, and determined that the FSAR supplement 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).

2.14.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team finds that those program elements for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. In addition, 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. **Predicated on satisfactory resolution of OI-2.2.2-1**, the project team accepts the applicant's commitment to submit a revised Reactor Vessel Internals Inspection Program for NRC review and approval by March 24, 2007.

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

2.15 STEAM GENERATOR TUBE INTEGRITY PROGRAM (PNP AMP B2.1.18)

In PNP LRA, Appendix B, Section B2.1.18, the applicant states that PNP AMP B2.1.18, "Steam Generator Tube Integrity Program," is an existing plant program that is consistent with GALL AMP XI.M19, "Steam Generator Tube Integrity."

2.15.1 Program Description

The applicant states, in the PNP LRA, that this program is an existing program that manages the aging effects of steam generator tubes and tube repairs. The program also manages the aging effects of accessible steam generator secondary side internal components and incorporates the guidance of NEI 97-06. The program manages aging effects through a balance of mitigation, inspection, evaluation, repair, and leakage monitoring measures. Component degradation is mitigated by controlling primary and secondary water chemistry. Eddy current testing is used to detect steam generator tube flaws and degradation. Visual examinations are performed to identify degradation of accessible steam generator secondary side internal components. Primary to secondary leakage is monitored during plant operation.

The applicant also states, in the PNP LRA, that the program credits its PNP AMP B2.1.21, “Water Chemistry Program,” for primary and secondary water chemistry control. The program also satisfies ASME Section XI, IWB-2500, Category B-Q requirements to perform volumetric examinations of steam generator tubes in the inservice inspection (ISI) program.

2.15.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B2.1.18 is consistent with GALL AMP XI.M19.

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 PNP AMP B2.1.18, including basis document, LR-AMPBD-24-SGINTEGRITY, “Steam Generator Tube Integrity Program,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.M19.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B2.1.18 and associated basis documents against GALL AMP XI.M19 for consistency.

The project team reviewed those portions of the Steam Generator Tube Integrity Program for which the applicant claims consistency with GALL AMP XI.M19 and finds that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant’s Steam Generator Tube Integrity Program provides reasonable assurance that the aging effects of steam generator tubes and tubes repairs are managed. The program also manages the aging effects of accessible steam generator secondary side internal components and incorporates the guidance of NEI 97-06. The project team finds the applicant’s Steam Generator Tube Integrity Program acceptable because it conforms to the recommended GALL AMP XI.M19, “Steam Generator Tube Integrity.”

2.15.3 Exceptions to the GALL Report

None

2.15.4 Enhancements

None

2.15.5 Operating Experience

The applicant states, in the PNP LRA, that PNP has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events and assesses these for applicability to its own operations. In addition, the PNP Corrective Action Program (CAP) is used to track, trend and evaluate plant issues/events. Those issues and events, whether external or plant-specific, that are potentially significant to the Steam Generator Tube Integrity Program at PNP are evaluated. The Steam Generator Tube Integrity Program is augmented, as appropriate, if these evaluations show that program changes will enhance program effectiveness.

The applicant states, in the PNP LRA, that using the OEP and CAP to focus on industry and plant operating experience ensures that Steam Generator Tube Integrity Program issues are addressed in a timely manner and that age related deterioration within the scope of the Steam Generator Tube Integrity Program will be effectively managed throughout the license renewal period.

The applicant also states, in the PNP LRA, that a review of the industry operating experience related to the steam generator tube integrity program revealed instances where degradation has occurred within the steam generators. In completing its review, the applicant looked at related issues which included degradation of steam generator tubes, tube sheet, mechanical plugs, tube support plates, girth welds, antivibration bars, etc., plus degradation associated with loose parts, foreign objects, sludge, water chemistry, and wear.

In addition, the applicant states, in the PNP LRA, that a review of the plant-specific operating experience revealed several instances where the steam generator tube integrity program has been instrumental in discovering material degradation. Steam generator tube degradation was discovered in the following areas:

- Top of tubesheet
- Within the tubesheet
- U-bends
- Mechanical wear at eggcrate supports, vertical straps, and diagonal bars.

The applicant states, in the PNP LRA, that the steam generator tube integrity program has been effective in identifying material degradation in a timely manner, thus ensuring that age related degradation of steam generator subcomponents will be effectively managed throughout the license renewal period.

Furthermore, the applicant states, in the PNP LRA, that the steam generators at PNP were replaced in late 1990. The new steam generators are improved in design, material selection, and construction. Included in the new design was a change in the tube support from solid plate to egg crate dividers along with other features to minimize corrosion crevices and denting.

The project team reviewed the operating experience provided in the PNP 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 the applicant’s steam generator tube integrity inspection reports and an assessment for the 2003 refueling outage. During the audit and review, the applicant explained that the steam generators at PNP are Combustion Engineering Model 2530. Each steam generator has 8219 tubes. The tube material is mill annealed Alloy 600. Prior to installation of the replacement steam generators, 308 tubes in steam generator E-50A and 309 tubes in steam generator E-50B, that were potentially susceptible to fretting wear, were plugged as a preventive measure. After 9 cycles of operation, 72 additional tubes in steam generator E-50A and 54 additional tubes in steam generator E-50B have been plugged. Therefore, steam generator E-50A has 7839 active tubes with 4.62% of the tubes plugged. Steam generator E-50B has 7856 active tubes with 4.42% of the tubes plugged. Active degradation mechanisms are structural wear in steam generator E-50B and axial ODSCC in steam generators E-50A/B.

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

2.15.6 FSAR Supplement

The applicant provides its FSAR Supplement for the Steam Generator Tube Integrity Program in PNP LRA, Appendix A, Section A2.18, which states that the Steam Generator Tube Integrity Program manages the aging effects of steam generator tubes and tube repairs. The program also manages the aging effects of accessible steam generator secondary side internal components and incorporates the guidance of NEI 97-06.

The applicant states that the program manages aging effects through a balance of mitigation, inspection, evaluation, repair, and leakage monitoring measures. Component degradation is mitigated by controlling primary and secondary water chemistry. Eddy current testing is used to detect steam generator tube flaws and degradation. Visual examinations are performed to identify degradation of accessible steam generator secondary side internal components. Primary to secondary leakage is monitored during plant operation.

The project team reviewed the FSAR Supplement for PNP AMP B2.1.18, 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).

2.15.7 Conclusion

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

On the basis of its review of the FSAR Supplement for this program, the project team finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

2.16 STRUCTURAL MONITORING PROGRAM (PNP AMP B2.1.19)

In PNP LRA, Appendix B, Section B2.1.19, the applicant states that PNP AMP B2.1.19, “Structural Monitoring Program,” is an existing plant program that is consistent with GALL AMP XI.S5, “Masonry Wall Program,” GALL AMP XI.S6, “Structures Monitoring Program,” and GALL AMP XI.S7, RG 1.127, “Inspection of Water-Control Structures Associated with Nuclear Power Plants,” with an enhancement.

2.16.1 Program Description

The applicant states, in the PNP LRA, that this program is an existing program that is designed to ensure that age related (as well as other) deterioration of plant structures (including masonry walls) and components within its scope is appropriately managed to ensure that each such structure or component retains the ability to perform its intended function. The program is implemented through visual examinations of these structures, components and other specified items. Damage or degradation found during visual examinations may be further evaluated by measurements and testing techniques as appropriate.

The applicant also states, in the PNP LRA, that this program also implements provisions of the Maintenance Rule, 10 CFR 50.65, that relate to masonry walls and water-control structures. It conforms to the guidance contained in RG 1.160, “Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,” and NUMARC 93-01 as well as Nuclear Energy Institute publication NEI 96-03. This NEI document, which supplements NUMARC 93-01, contains additional guidance specific to the monitoring of structures.

In addition, the applicant states, in the PNP LRA, that initial baseline inspections under the Structural Monitoring Program were performed, as required by 10 CFR 50.65, starting in late 1996. A second complete inspection was performed in 1999 to validate the initial inspection results. Subsequent inspections follow a 10-year interval schedule that is similar to Inspection Plan B defined in the ASME Boiler & Pressure Vessel Code, Section XI, Table IWE-2412-1.

The applicant states, in the PNP LRA, that the 10-year inspection interval is divided into three 40 month periods. Approximately one third of the items in the program scope are examined in each period and all items are examined at least once during the 10-year interval. The first interval, first period, inspections have been completed, and PNP is currently in the first interval, second period inspection cycle. Other features may have greater inspection frequencies such as watertight/flood barrier inspections (at least once per five years) and below-the-waterline water-control structures (once every five years).

The applicant also states, in the PNP LRA, that augmented inspection is required for items that have been repaired or that exhibit significant damage or deterioration. It may also be required for items subject to aggressive environments. Items that are tagged for augmented inspection following repair or for reasons of damage/deterioration are examined, at a minimum, in the period immediately following the one during which the repair was performed or the deleterious condition was found. Augmented inspection may be performed on a 40 month period basis or at more closely spaced intervals as specified by the Structural Monitoring Coordinator or in plant procedures.

Furthermore, the applicant states, in the PNP LRA, that the Structural Monitoring Program includes requirements for the inspection of water-control structures and structural elements that are accessible above the waterline. PNP is not committed to Regulatory Guide (RG) 1.127, and GALL AMP XI.S7 provides guidance to plants that are not committed to RG 1.127. This guidance includes addressing those structures above the waterline in GALL AMP XI.S6, and addressing below-the-waterline structures in the applicable sections of GALL AMP XI.S7.

2.16.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B2.1.19 is consistent with GALL AMP XI.S5, GALL AMP XI.S6, and 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 PNP AMP B2.1.19, including basis document, LR-AMPBD-25-STRUCMON, “Structural Monitoring Program,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.S5, GALL AMP XI.S6, and GALL AMP XI.S7.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B2.1.19 and associated basis documents against GALL AMP XI.S5, GALL AMP XI.S6, GALL AMP XI.S7, and ISG-3 for consistency.

GALL AMP XI.S5, Masonry Wall Program, under detection of aging effects program element, has the following statement: The frequency of inspection is selected to ensure there is no loss of intended function between inspections. The inspection frequency may vary from wall to wall, depending on the significance of cracking in the evaluation basis. Unreinforced masonry walls that have not been contained by bracing warrant the most frequent inspection, because the development of cracks may invalidate the existing evaluation basis. The applicant makes the following statement in PNP AMP B2.1.19 under detection of aging effects program element for masonry walls: The PNP program applies the same periodic visual examination techniques to masonry walls and to concrete structural elements as prescribed by this program element. Periodicity of examinations may vary, according to different reinforcement masonry configurations.

The applicant was asked to clarify whether unreinforced masonry walls without bracing were inspected more frequently then reinforced or braced masonry walls. The applicant responded that currently PNP does not differentiate block walls based on the type of reinforcing. All block walls are treated the same with respect to inspection under the PNP Structural Monitoring Program.

In a letter dated August 25, 2005, the applicant states that a clarification to PNP AMP B2.1.19, “Structural Monitoring Program” is being provided to better demonstrate consistency with GALL AMP XI.S5, “Masonry Wall Program.” Specifically, PNP AMP B2.1.19 is revised to read,

> In addition, inspections for unreinforced block walls that are not contained by bracing will be performed on a more frequent basis than the periodicity of at least once every 10 year interval specified for reinforced or braced block walls.

Also in PNP LRA Section A2.19, Structural Monitoring Program, page A-8, the following sentence is added to the end of the second paragraph:

> In addition, the program specifies that inspections for unreinforced block walls that are not contained by bracing will be performed on a more frequent basis than the normal frequency of once each 10 year interval specified for reinforced or braced block walls.

The project team finds the response acceptable. With the clarification statements made by the applicant above, the applicant's Structural Monitoring Program is now consistent with element 4 of GALL AMP XI.S5, Masonry Wall Program.

GALL AMP XI.S6, Structures Monitoring Program, under detection of aging effects program element, has the following statement: 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. The applicant states that PNP does not have an aggressive below grade environment nor flowing underground water and is not required to inspect inaccessible areas below the grade of structures within the scope of license renewal. The applicant was asked by the project team if PNP will take advantage of inspection opportunities for structures within the scope of license renewal that have areas that are identified as inaccessible. As inaccessible areas become accessible by such means as excavation or other method, will opportunistic inspections of those areas be performed. In response, the applicant stated that the inspection of normally inaccessible areas of structures within the scope of license renewal would be performed when the opportunity arises and the requirement made part of the program.

In a letter dated August 25, 2005, the applicant states that due to the lack of aggressive groundwater at PNP, a plant-specific program is not required to age manage inaccessible below grade concrete as discussed in ISG-3. However, to validate this determination, PNP will perform an inspection of opportunity on inaccessible concrete when excavation work uncovers a significant depth (i.e., several feet or more) of normally inaccessible concrete.

Accordingly, the following sentence is added to PNP AMP B2.1.19, Structural Monitoring Program, after the first paragraph of the detection of aging effects program element section on page B-141:

> In addition, the program provides for inspections of opportunity of normally inaccessible below grade concrete when excavation work uncovers a significant depth (i.e., several feet or more) to provide access for inspection.

In addition, the following sentence is added to PNP LRA Section A2.19, Structural Monitoring Program, page A-8, following the second sentence of the first paragraph:

> In addition, the program provides for inspections of opportunity of normally inaccessible below grade concrete when excavation work uncovers a significant depth (i.e., several feet or more) to provide access for inspection.

The project team reviewed the applicant's response and finds it acceptable. The applicant has elected to take advantage of inspection opportunities for structures within the scope of license renewal that normally have areas that are identified as inaccessible. The inspection of normally inaccessible areas will verify that aging effects are not occurring and a plant-specific AMP is indeed not required.

As discussed previously, the applicant states, in the PNP LRA, that PNP does not have an aggressive below grade environment. Although not required by GALL AMP XI.S6, the PNP Structural Monitoring Program does not discuss the need or lack of need to perform periodic ground water monitoring to ensure that the below -grade water chemistry does not become aggressive in the future. The applicant was asked by the project team to justify not performing periodic ground water monitoring during the CLB and potential extended license period to check water chemistry for non-aggressiveness.

In a letter dated September 2, 2005 (ML052500207), the applicant states that as discussed in PNP LRA Section 3.5.2.2.1.1, on pages 3-269 - 3-271, ground water chemistry records are available for the current operating period, and provide the basis that water in contact with PNP's below-grade concrete is currently non-aggressive, and has been non-aggressive over at least the last 40 years. To ensure ground water remains non-aggressive over the extended operating period, ground water sampling for pH, chlorides, and sulfates will be performed as part of the Structural Monitoring Program with a periodicity not to exceed every 5 years. Accordingly, the following changes are made to PNP LRA Section B2.1.19:

> On page B-137, after the last paragraph of the section entitled program description, the following paragraph is added: "For below grade inaccessible concrete, Interim Staff Guidance #3 (ISG-3) discusses potential aging effects requiring management (AERMs) if the below grade environment is aggressive (pH <5.5, chlorides > 500 ppm, or sulfates > 1500 ppm. Historical groundwater sampling performed at Palisades shows that the below grade environment is and has been non-aggressive by a significant margin. As part of the Structural Monitoring Program, Palisades will continue to monitor groundwater on a periodic basis to ensure it remains non-aggressive such that the associated AERMs remain not applicable."
>
> On page B-140, after the last paragraph of the section entitled XI.S6, Structures Monitoring, under parameters monitored, inspected, and/or tested, the following paragraph is added: "Local groundwater will be sampled on a periodic basis to ensure pH values and concentrations of chlorides and sulfates remain below levels considered aggressive to concrete."
>
> On page B-142, after the last paragraph of the section entitled XI.S6, Structures Monitoring, under monitoring and trending, the following paragraph is added: "Groundwater sampling for pH, chlorides, and sulfates will be performed to ensure the below grade environment remains non-aggressive with a periodicity not to exceed every 5 years."
>
> On page B-143, after the last paragraph of the section entitled XI.S6, Structures Monitoring, under acceptance criteria, the following paragraph is added: "Groundwater sampling will verify a non-aggressive below grade environment exists, as described in ISG-3, by ensuring pH > 5.5, chlorides < 500 ppm and sulfates are < 1500 ppm."

In addition to the above, conforming changes are made in various locations of PNP LRA Section 3.5.2.2 which state that continued groundwater sampling is unnecessary. Reference Section 3.5.2 of this audit and review report for the evaluation of the specific changes to PNP LRA Section 3.5.2.2.

A conforming change is also made to the FSAR description of the Structural Monitoring Program in PNP LRA Section A2.19, by adding the following sentence at the end of the first paragraph: "As part of the Structural Monitoring Program, groundwater sampling for pH, chlorides, and sulfates will be performed, with a periodicity not to exceed every 5 years, to ensure the below grade environment remains non-aggressive."

The project team reviewed the applicant's response and finds it acceptable. The applicant has elected to perform periodic ground water monitoring during the CLB and potential extended license period to ensure that the below-grade water chemistry does not become aggressive in the future. The monitoring of the ground water will verify that aging effects due to an aggressive environment will not occur.

The project team reviewed those portions of the Structural Monitoring Program for which the applicant claims consistency with GALL AMP XI.S5, GALL AMP XI.S6, and GALL AMP XI.S7 and finds that they are consistent with the GALL Report AMPs. Furthermore, the project team concludes that the applicant's Structural Monitoring Program provides reasonable assurance that the aging of construction materials within the scope of license renewal, which include structural steel, concrete, masonry block and sealing materials, will be properly managed for the period of extended operation. The project team finds the applicant's Structural Monitoring Program acceptable because it conforms to the recommended GALL AMP XI.S5, "Masonry Wall Program," GALL AMP XI.S6, "Structures Monitoring Program," and GALL AMP XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," with enhancements as described below.

2.16.3 Exceptions to the GALL Report

None

2.16.4 Enhancements

The applicant states, in the PNP LRA, that the enhancement in meeting the GALL Report element as follows:

Element:	1: Scope of Program
Enhancement:	Incorporate into the Structural Monitoring Program all structural members listed in Tables 3.5.2-1 through 3.5.2-10 that will use the Structural Monitoring Program as an AMP.

The GALL Report identifies the following recommendations for the scope of program program element associated with the enhancement:

> The scope includes all masonry walls identified as performing intended functions in accordance with 10 CFR 54.4.
>
> The applicant specifies the structure/aging effect combinations that are managed by its Structures Monitoring Program.
>
> 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 states, in the PNP LRA, that this enhancement will incorporate into its Structural Monitoring Program all structural members listed in PNP LRA Tables 3.5.2-1 through 3.5.2-10 that are in the scope of license renewal and will use the Structural Monitoring Program as an AMP. The enhancement will be incorporated into the Structural Monitoring Program prior to the period of extended operation.

The project team finds that by incorporating into the Structural Monitoring Program all structural members listed in PNP LRA Tables 3.5.2-1 through 3.5.2-10, detection of degradation due to aging of all long-lived passive structural members within the scope of license renewal before there is a loss of intended function will be ensured. After implementation of this enhancement, the project team finds that by specifying the structure/aging effect combinations that are managed by its Structures Monitoring Program, the PNP Structural Monitoring Program will be consistent with the recommendation of GALL AMP XI.S5, GALL AMP XI.S6, and GALL AMP XI.S7. On the basis that the scope of the Structural Monitoring Program will be well defined with the enhancement, the project team finds this enhancement acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

2.16.5 Operating Experience

The applicant states, in the PNP LRA, that PNP has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events and assesses these for applicability to its own operations. In addition, the PNP Corrective Action Program (CAP) is used to track, trend and evaluate plant issues/events. Those issues and events, whether external or plant-specific, that are potentially significant to the structures and other items within the scope of the PNP Structures Monitoring Program are evaluated. The Structural Monitoring Program is augmented, as appropriate, if these evaluations show that program changes will enhance item performance and, as a consequence, operational safety.

The applicant states, in the PNP LRA, that using the OEP and CAP to focus on industry and plant operating experience ensures that Structural Monitoring Program issues are addressed in a timely manner and that age related deterioration of the items within the program scope is effectively managed throughout the license renewal period.

The applicant also states, in the PNP LRA, that a review of industry operating experience associated with the Structures Monitoring Program and aging reveals issues and instances related to:

- Corrosion of steel ice condenser containment vessels caused by boric acid and condensation
- Cracks in concrete floors caused by flexing and shrinkage

Various related NRC and/or industry generic communications have been issued due to emerging issues, and, in turn, have been incorporated into the program as applicable.

In addition, the applicant states, in the PNP LRA, that a review of plant-specific operating experience related to the Structural Monitoring Program and aging revealed that the following issues have been addressed:

- Settling of air compressor foundations
- Watertight barrier degradation
- Spalled concrete and exposed anchor bolts
- Intake crib damage due to ice and to wave action
- Cracking of concrete beams in the auxiliary building
- Corrosion of condenser rock anchors caused by standing water and debris
- Degradation of snubber anchor support structure concrete and grout
- Deterioration of floor plugs due to leaking water
- Moisture separator reheater foundation cracking
- Cracks in concrete duct bank
- Cracks in west ESS room west wall
- Spalled concrete on wall of 1-2 diesel generator exhaust plenum
- Groundwater leaks in auxiliary feedwater pump room floor

Furthermore, the applicant states, in the PNP LRA, that the PNP Structural Monitoring Program has demonstrated that it provides reasonable assurance that aging effects are being managed for Structural Monitoring Program SSCs. Additionally, this has been demonstrated through inspection reports, program health reports, and the Corrective Action Program.

The project team reviewed the above operating experience for watertight barrier degradation, spalled concrete and exposed anchor bolts, cracking of concrete beams in the auxiliary building, corrosion of condenser rock anchors caused by standing water and debris, and deterioration of floor plugs due to leaking water and finds that the applicant's existing Structural Monitoring Program was effective in identifying deterioration of plant structures and components within its scope. The above deficiencies were placed in the PNP Corrective Action Program and dispositioned for repair, accept as is or accept as is with additional monitoring. The listed operating experience demonstrated that the PNP Structural Monitoring Program is effective in ensuring that age related deterioration of plant structures and components within the scope of license renewal is adequately managed to ensure that these structures and components maintain their ability to perform their intended function.

The project team also reviewed the operating experience for groundwater leaks in auxiliary feedwater pump room floor revealed some areas of the Structural Monitoring Program which needed strengthening. The groundwater leaks in the auxiliary feedwater pump room were identified on Corrective Action Program (CAP) report, CAP045406. Based on the written description of the groundwater leakage into the feedwater pump room, the project team believed it to be a deficiency that had been occurring since original plant construction. The written description identified water leakage into the room carrying sand at a rate sufficient to overflow installed catch barriers. The disposition of the deficiency was that it was an existing condition that had been occurring for years and had been evaluated by engineering as not a concern. The project team discussed the issue with the applicant to determine how severe the condition was and why it had not been repaired. The applicant's engineering staff stated that the written description on CAP045406 exaggerated the severity of the condition and the water ingress was seepage and not leakage and there was no sand. The project team agreed that if the condition was not as severe as stated on CAP045406, repairs might not be necessary, but stated that augmented inspections need to be performed in accordance with the Structural Monitoring Program for areas that exhibit deterioration. In accordance with PNP AMP 2.1.19, this item would result in the applicant performing augmented inspections.

The applicant states, in PNP AMP B2.1.19, “Structural Monitoring Program,” that initial baseline structural inspections under the Structural Monitoring Program were performed, as required by 10 CFR 50.65, starting in late 1996. A second complete inspection was performed in 1999 to validate the initial inspection results. The project team asked the applicant to review the structural inspections performed in 1996 and 1999 of the auxiliary feedwater pump room to determine if the water ingress condition was noted. The applicant stated that the condition had not been identified during either inspection. As a result of the project team questions, the applicant initiated Corrective Action Program CAP048474 to identify the lack of identification and the need for inspectors to document them. With the strengthening of the applicant’s Structural Monitoring Program through its corrective action process, the project team concludes that all deterioration of plant structures will be identified, documented, evaluated, and repaired as necessary with augmented inspections as required per the program.

The project team reviewed the operating experience provided in the PNP LRA, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

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

2.16.6 FSAR Supplement

The applicant provides its FSAR Supplement for the Structural Monitoring Program in PNP LRA, Appendix A, Section A2.19, which states that the Structural Monitoring Program is designed to ensure that age related (as well as other) deterioration of plant structures (including masonry walls) and components within its scope is appropriately managed to ensure that each such structure or component retains the ability to perform its intended function. The program is implemented through visual examination of these structures, components and other specified items. Damage or degradation found during visual examination may be further evaluated by measurements and testing techniques as appropriate.

This program also implements provisions of the Maintenance Rule, 10 CFR 50.65, that relate to masonry walls and water-control structures. It conforms to the guidance contained in RG 1.160 and NUMARC 93-01 as well as Nuclear Energy Institute publication NEI 96-03. This NEI document, which supplements NUMARC 93-01, contains additional guidance specific to the monitoring of structures. The applicant has committed to enhancing the program procedures prior to the period of extended operation. Reference Section 2.16.2 of this audit and review report for additions by the applicant to the FSAR Supplement in PNP LRA, Appendix A, Section A2.19 for the Structural Monitoring Program.

The commitments for the PNP AMP B2.1.19 program enhancements are contained in the applicant's March 22, 2005 letter to the NRC.

The project team reviewed the FSAR supplement and enhancement commitments for PNP AMP B2.1.19, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR FSAR supplement table and as required by 10 CFR 54.21(d).

2.16.7 Conclusion

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

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

2.17 WATER CHEMISTRY PROGRAM (PNP AMP B2.1.21)

In PNP LRA, Appendix B, Section B2.1.21, the applicant states that PNP AMP B2.1.21, "Water Chemistry Program," is an existing plant program that is consistent with GALL AMP XI.M2, "Water Chemistry."

2.17.1 Program Description

The applicant states, in the PNP LRA, that this program is an existing program that is credited for managing aging effects such as loss-of-material due to general, pitting and crevice corrosion; cracking due to SCC; and steam generator tube degradation caused by denting, intergranular attack (IGA) and outer diameter stress corrosion cracking (ODSCC), by controlling the environment to which internal surfaces of systems and components are exposed. The aging effects are minimized by controlling the chemical species that cause the underlying mechanisms that result in these aging effects. The program provides assurance that an elevated level of contaminants and, where applicable, oxygen does not exist in the systems and components covered by the program, thus minimizing the occurrences of aging effects, and maintaining each component's ability to perform the intended functions. The program is based on the guidelines in EPRI TR-105714, Rev. 5, and TR-102134, Rev. 5. The One-Time Inspection Program verifies that the Water Chemistry Program is managing the effects of aging of selected components in low flow or stagnant areas.

The applicant also states, in the PNP LRA, that it is important to note that both the EPRI Primary And Secondary Water Chemistry Guidelines make a clear distinction between "control parameters" and "diagnostic parameters." Strict adherence to control parameters is expected, whereas diagnostic parameters are suggested, but can be plant-specific. Deviations from EPRI recommended diagnostic parameters are not considered exceptions to the GALL Report.

The applicant states, in the PNP LRA, that the GALL Report Water Chemistry Control Program is based on guidelines in EPRI Report TR-105714, Rev. 3 for primary water chemistry, and TR-102134, Rev. 3 for secondary water chemistry, while PNP has adopted TR-105714, Rev. 5 and TR-102134, Rev. 5. Furthermore, the applicant states that future revisions of the EPRI Primary and Secondary Water Chemistry Guidelines will be adopted as required, commensurate with industry standards. The applicant has not considered this as an exception to the GALL Report.

2.17.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B2.1.21 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 PNP AMP B2.1.21, including basis document, LR-AMPBD-26-CHEMISTRY, "Water Chemistry Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M2.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B2.1.21 and associated basis documents against GALL AMP XI.M2 for consistency.

The GALL AMP XI.M2 program element, scope of program, states that water chemistry control is in accordance with the guidelines in EPRI TR-105714, Revision 3 for primary water chemistry in PWRs; EPRI TR-102134, Revision 3, for secondary water chemistry in PWRs; or later revisions or updates of these reports as approved by the staff. The PNP AMP B2.1.21 program element, scope of program, states that the program accomplishes this task by monitoring and controlling known detrimental contaminants such as chlorides, fluorides, dissolved oxygen and sulfate concentrations for water chemistry based on guidelines in EPRI TR-105714, Revision 5 for primary water chemistry, and TR-102134, Revision 5 for secondary water chemistry. The program includes sampling activities for primary, borated, secondary, and makeup water systems. The applicant claims consistency with the GALL Report and explains that using a later revision of the EPRI guidelines is not considered as an exception. The project team found this different from the GALL Report recommendation and asked the applicant to provide a comparison between the monitored parameters for Revision 3 and Revision 5 of the EPRI guidelines and explain why a later version is acceptable by providing verification that none of the controlled parameters are relaxed in the later revisions.

The applicant responds, in a letter dated August 25, 2005, with the following:

> NMC understands the NRC position that revisions of codes or standards used in AMPs that are not the same as those referenced in the GALL, are to be identified as exceptions to GALL. Therefore, code or standard revisions that are used in Palisades' programs, but are not referenced by either the 2001 or 2005 GALL descriptions, will be treated as exceptions to the GALL, and justification will be provided as required. Revisions or supplements to the affected program descriptions will be submitted to the NRC.

XI.M2 - Primary Chemistry - The 2001 and 2005 GALL revisions reference EPRI TR-105714 Rev 3, and the Palisades AMP is based on Rev 5. NMC will prepare and submit a comparison of TR-105714 revision 5 with revision 3 to identify the material changes that impact aging management and justify their acceptability by October 31, 2005. If necessary, the Water Chemistry Program description will be revised to identify and justify use of TR-105714, Revision 5, as an exception to the GALL program description.

XI.M2 - Secondary Chemistry - 2001 and 2005 GALL revisions reference TR-102134 Rev 3, and the Palisades AMP is based on Rev 6. NMC will prepare and submit a comparison of TR-102134 revision 6 with revision 3 to identify the material changes that impact aging management and justify their acceptability by October 31, 2005. If necessary, the Water Chemistry Program description will be revised to identify and justify use of TR-102134, Revision 6, as an exception to the GALL program description.

Based on the information provided by the applicant in the August 25, 2005 letter, the project team expects to find that using a later revision of the EPRI documents is acceptable. **[This is Confirmatory Item CI-2.17.2-1]**.

GALL AMP XI.M2 states that in certain cases, verification of the effectiveness of the Chemistry Control Program is undertaken to ensure that significant degradation is not occurring and the component intended function will be maintained during the period of extended operation. An acceptable verification program is a one-time inspection of selected components at susceptible locations in the system. The applicant states that it uses PNP AMP B2.1.13, “One-Time Inspection Program,” to verify that the Water Chemistry Program is managing the effects of aging of selected components in low flow or stagnant areas. The project team noted the PNP LRA has not provided clarification that the low flow and stagnant locations are the only susceptible locations that require inspection by the applicant’s One-Time Inspection Program.

The applicant responds, in a letter dated August 25, 2005, with the following:

While the most susceptible locations may be the low flow or stagnant potions of a particular system, it was not intended to limit the selection of susceptible locations to low flow or stagnant portions of a system. Upon implementation of the One-Time Inspection Program, NMC plans to group all identified components within the system with the same material, same environment, and same aging mechanism. From this group, the most susceptible locations will be selected for inspection. When determining the most susceptible locations, all portions of the system(s) will be considered, not just the low flow or stagnant sections. Therefore, the following changes are made to the Water Chemistry and One-Time Inspection Program descriptions in Appendix B of the PNP LRA:

On page B-97, under Program Description, revise the first bullet of the third paragraph to read, “To verify the effectiveness of water chemistry control for managing the effects of aging in portions of piping exposed to a treated water environment.”

On page B-103, under Detection of Aging Affects Related to XI.M32, One Time Inspection, revise the second paragraph in its entirety to read, "To verify that the Water Chemistry Program and the Closed Cycle Cooling Water Program are mitigating the applicable aging effects, visual examinations or other appropriate NDE methodology will be used when components are inspected."

On page B-156 , under Detection of Aging Affects, revise the last sentence of the first paragraph to read, "In addition, inspections of selected components at susceptible locations of a system, performed under the One-Time Inspection Program, provide verification of the effectiveness of the Water Chemistry Program."

The project team reviewed the applicant's response. The project team finds that the applicant provided adequate information regarding the selection of susceptible locations that is not limited to low flow or stagnant portions of a system. Also, the applicant revised its One-Time Inspection Program for verification of the effectiveness of the Water Chemistry Program. On this basis, the project team finds this acceptable.

The project team reviewed those portions of the Water Chemistry Program for which the applicant claims consistency with GALL AMP XI.M2 and finds that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's Water Chemistry Program provides reasonable assurance that it will mitigate aging effects such as loss of material due to general, pitting, and crevice corrosion; cracking due to SCC and steam generator tube degradation caused by denting, intergranular attack and outer diameter stress corrosion cracking. The project team finds that, **predicated on satisfactory resolution of CI-2.17.2-1**, the applicant's Water Chemistry Program acceptable because it conforms to the recommended GALL AMP XI.M2, "Water Chemistry."

2.17.3 Exceptions to the GALL Report

None

2.17.4 Enhancements

None

2.17.5 Operating Experience

The applicant states, in the PNP LRA, that PNP has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events and assesses these for applicability to its own operations. In addition, PNP relies on the EPRI organization to collect and interpret, in accordance with the Water Chemistry Guidelines, industry operating experience which may have an impact on chemistry control. The PNP Corrective Action Program (CAP) is used to track, trend and evaluate plant and industry issues/events. Those issues and events, whether external or plant-specific, that are potentially significant to water chemistry at PNP are evaluated. The Water Chemistry Program is augmented, as appropriate, if these evaluations show that program changes will enhance water chemistry and operational safety.

The applicant states, in the PNP LRA, that using the OEP and CAP to focus on industry and plant operating experience ensures that Water Chemistry Program issues are addressed in a timely manner and that age-related deterioration of SSCs within the scope of the Water Chemistry Program will be effectively managed throughout the license renewal period.

The applicant also states, in the PNP LRA, that a review of industry operating experience associated with the Water Chemistry Program and aging reveals issues and instances related to:

- Cracking in steam generator welds
- Cracking and pitting of steam generator tubes and components
- Alloy 600 cracking
- Thinning of pipe and components due to erosion/corrosion
- Cracking in safety injection accumulator nozzles
- High wear of reactor coolant pump aluminum oxide coated seals
- Cracking of control rod drive housings
- Cracking of pressurizer instrument tap nozzles
- Cracking of safety injection piping
- Cracking in feedwater piping
- Chemical impurity intrusions into primary and secondary systems
- Resin intrusions into the primary coolant systems.

In addition, the applicant states that a review of plant-specific operating experience related to the Water Chemistry Program and aging revealed that the following issues have been addressed:

- Defective tubes in the main condenser due to steam impingement wear and microbiologically influenced corrosion (MIC) pitting
- Exceeding action level 3 limits for steam generator cation conductivity

The applicant states, in the PNP LRA, that the second item involved exceeding of action level 3 limits for steam generator cation conductivity, which resulted in a shutdown of the plant. The cause of the high conductivity was traced to intrusion of glass-blasting material left in the turbine following a major overhaul/replacement of the turbine. Although there were project oversight weaknesses identified in the events leading up to this chemistry excursion, proper chemistry monitoring quickly identified the rising cation conductivity levels, and subsequent actions prevented long term age-related degradation of components as action level 3 limits were exceeded for less than six hours. Compensatory actions were taken over the next cycle to ensure a high degree of contaminant removal or neutralization.

Furthermore, the applicant states, in the PNP LRA, that the PNP Water Chemistry Program has demonstrated on several occasions that it provides reasonable assurance that aging effects are being managed for Water Chemistry Program SSCs. This has been demonstrated through NRC inspection reports, audits, self-assessments, and the Corrective Action Program.

The project team reviewed the above operating experience related to the applicant's Water Chemistry Program. The project team finds that there have been no significant increases of the controlled and diagnostic parameters above the EPRI guidelines action levels. The PNP operating experience listed above is typical of the issues that are found in the corrective actions where a parameter has exceeded an EPRI action level. The project team did not identify any operating experience related to the applicant's Water Chemistry Program that would require any modification.

The project team reviewed the operating experience provided in the PNP LRA, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

On the basis of its review of the above industry and plant-specific operating experience and discussions with the applicant's technical staff, the project team concludes that, **predicated on satisfactory resolution of CI-2.17.2-1**, the applicant's Water Chemistry Program will adequately manage the aging effects that are identified in the PNP LRA for which this AMP is credited.

2.17.6 FSAR Supplement

The applicant provides its FSAR Supplement for the Water Chemistry Program in PNP LRA, Appendix A, Section A2.21, which states that the Water Chemistry Program manages aging effects such as loss-of-material due to general, pitting and crevice corrosion; cracking due to SCC; and steam generator tube degradation caused by denting, intergranular attack (IGA) and outer diameter stress corrosion cracking (ODSCC), by controlling the environment to which internal surfaces of systems and components are exposed. The aging effects are minimized by controlling the chemical species that cause the underlying mechanisms that result in these aging effects. The program provides assurance that an elevated level of contaminants and, where applicable, oxygen does not exist in the systems and components covered by the program, thus minimizing the occurrences of aging effects, and maintaining each component's ability to perform the intended functions. The program is based on the guidelines in EPRI TR-105714 and TR-102134.

The project team reviewed the FSAR Supplement for PNP AMP B2.1.21, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR FSAR Supplement table and as required by 10 CFR 54.21(d).

2.17.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. The project team finds that, **predicated on satisfactory resolution of CI-2.17.2-1**, 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 FSAR Supplement for this program, the project team finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

2.18 ELECTRICAL EQUIPMENT QUALIFICATION PROGRAM (PNP AMP B3.1)

In PNP LRA, Appendix B, Section B3.1, the applicant states that PNP AMP B3.1, “Electrical Equipment Qualification Program,” is an existing plant program that is consistent with GALL AMP X.E1, “Environmental Qualification (EQ) of Electric Components.”

2.18.1 Program Description

The applicant states, in the PNP LRA, that this program is an existing program that implements the requirements of 10 CFR 50.49, “Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants,” at PNP. 10 CFR 50.49 defines the scope of components to be included, requires the preparation and maintenance of a list of within the scope of license renewal components, and requires the preparation and maintenance of a qualification file that includes component performance specifications, electrical characteristics, the environmental conditions to which the components could be subjected, and the basis for qualification. 10 CFR 50.49(e)(5) contains provisions for aging that require, in part, consideration of all significant types of aging degradation that can affect component functional capability. 10 CFR 50.49(e)(5) also requires replacement or refurbishment of qualified components prior to the end of its designated life, unless additional life is established through ongoing qualification. EQ programs manage component thermal, radiation, and cyclical aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods.

The Electrical Equipment Qualification (EEQ) Program is explicitly governed by regulation independent from license renewal, and the GALL Report merely credits that required program as sufficient for license renewal purposes. EEQ program activities that satisfy license renewal considerations will continue to be managed in accordance with 10 CFR 50.49.

2.18.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B3.1 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 for PNP AMP B3.1, including basis document, LR-AMPBD-11-EEQ, “Electrical Equipment Qualification Program,” which provides an assessment of the AMP elements' consistency with GALL AMP X.E1.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B3.1 and associated basis documents against GALL AMP X.E1 for consistency.

During the audit and review, the project team noted a difference between the GALL AMP and PNP AMP under the program description. The results of the environment qualification of electrical equipment in PNP LRA, Section 4.4, indicates that the aging effects of the EQ of electrical equipment identified in the TLAA will be managed during the extended period of operation under 10 CFR 54.21(c)(1)(iii). However, no information is provided in PNP AMP B3.1 on the attribute of a reanalysis of an aging evaluation to extend the qualification life of electrical equipment identified in the TLAA. The important attributes of a reanalysis are the analytical methods, the data collection and reduction methods, the underlying assumptions, and the acceptance criteria and correction actions. GALL AMP X.E1 under EQ Component Reanalysis

Attributes clearly describes each attribute of a reanalysis under program description. PNP AMP does not include this information. The project team requested that the applicant provide these attributes under the program description. The applicant informed the project team that it agrees to revise PNP AMP B3.1 to include EQ component reanalysis attributes as described in GALL AMP X.E1 under the program description. The project team reviewed the program element and finds that it is consistent with the GALL Report. The project team finds the applicant's response acceptable because this will make it consistent with GALL AMP's program description. In a letter dated August 25, 2005, the applicant revises PNP AMP B3.1 to incorporate this change.

The project team reviewed those portions of the Electrical Equipment Qualification Program for which the applicant claims consistency with GALL AMP X.E1 and finds that they are consistent with the GALL Report AMP. Furthermore, the project team concludes that the applicant's Electrical Equipment Qualification Program provides reasonable assurance that the effect of aging will be adequately managed so that the intended function will be maintained consistent with the CLB during the period of extended operation. The project team finds the applicant's Electrical Equipment Qualification Program acceptable because it conforms to the recommended GALL AMP X.E1, "Environmental Qualification (EQ) of Electric Components."

2.18.3 Exceptions to the GALL Report

None

2.18.4 Enhancements

None

2.18.5 Operating Experience

The applicant states, in the PNP LRA, that it has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events and assesses these for applicability to its own operations. In addition, the PNP Corrective Action Program (CAP) is used to evaluate, track, and trend plant issues/events. Those issues and events, whether industry or plant-specific, that are potentially significant to the Electrical Equipment Qualification Program at PNP, are evaluated. The Electrical Equipment Qualification Program is augmented, as appropriate, if these evaluations show that program changes are required to enhance program effectiveness.

The applicant states, in the PNP LRA, that using the OEP and CAP to focus on industry and plant operating experience ensures that Electrical Equipment Qualification Program issues are addressed in a timely manner and that age-related deterioration of components within the scope of the Electrical Equipment Qualification Program will be effectively managed throughout the period of extended operation.

The applicant also states, in the PNP LRA, that a review of applicable operating experience was performed to determine if there were deficiencies or recurring failures that would raise questions about EEQ Program effectiveness. No significant items were found. Similar reviews were performed of inspection, assessment, and audit reports. No significant findings were identified. Some issues have been identified that have resulted in appropriate corrective actions and enhancements.

In addition, the applicant states, in the PNP LRA, that the PNP Electrical Equipment Qualification Program has demonstrated that it provides reasonable assurance that aging effects are being managed for all EQ components. This has been demonstrated through NRC inspection reports, audits, self-assessments, and the Corrective Action Program.

The project team reviewed the operating experience provided in the PNP LRA, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

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

2.18.6 FSAR Supplement

The applicant provides its FSAR Supplement for the Electrical Equipment Qualification Program in the PNP LRA, Appendix A, Section A3.1, which states that the Electrical Equipment Qualification Program is an existing program that implements the requirements of 10 CFR 50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants," at PNP. 10 CFR 50.49 defines the scope of components to be included, requires the preparation and maintenance of a list of within the scope of license renewal components, and requires the preparation and maintenance of a qualification file that includes component performance specifications, electrical characteristics, the environmental conditions to which the components could be subjected, and the basis for qualification. 10 CFR 50.49(e)(5) contains provisions for aging that require, in part, consideration of all significant types of aging degradation that can affect component functional capability. 10 CFR 50.49(e)(5) also requires replacement or refurbishment of qualified components prior to the end of its designated life, unless additional life is established through ongoing qualification. EQ programs manage component thermal, radiation, and cyclical aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods.

The project team reviewed the FSAR Supplement for PNP AMP B3.1, 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).

2.18.7 Conclusion

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

On the basis of its review of the FSAR Supplement for this program, the project team finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

2.19 FATIGUE MONITORING PROGRAM (PNP AMP B3.2)

In PNP LRA, Appendix B, Section B3.2, the applicant states that PNP AMP B3.2, “Fatigue Monitoring Program,” is a new plant program that is consistent with GALL AMP X.M1, “Metal Fatigue of Reactor Coolant Pressure Boundary.”

2.19.1 Program Description

In the PNP LRA, the applicant states that this is a new program which ensures that limits on fatigue usage are not exceeded during the renewal term. The program monitors and tracks selected cyclic loading transients (cycle counting) and their effects on susceptible components. PNP has selected this option under 10 CFR 54.21 to manage cracking due to metal fatigue of the reactor coolant pressure boundary during the extended period of operation.

The applicant also states, in the PNP LRA, that its Fatigue Monitoring Program provides the cycle counting activities credited in PNP LRA Section 4.3 for confirming analytically derived cumulative usage values for applicable locations. Specific locations that may be subject to cyclic loading that could cause fatigue cracking are monitored using a computer-based monitoring program provided by EPRI, FatiguePro. If warranted, other monitoring methods in addition to cycle counting may also be employed under this program to monitor specific locations.

2.19.2 Consistency with the GALL Report

In the PNP LRA, the applicant states that PNP AMP B3.2 is consistent with GALL AMP X.M1.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report for PNP AMP B3.2, including basis document, LR-AMPBD-12-FATIGUE, “Fatigue Monitoring Program,” which provides an assessment of the AMP elements' consistency with GALL AMP X.M1.

The project team also reviewed the program elements (see Section 1.5.1 of this audit and review report) contained in PNP AMP B3.2 and associated basis documents against GALL AMP X.M1 for consistency.

The applicant also discusses, in the PNP LRA, for the program element, scope of program, that components monitored will include those identified in NUREG/CR-6260, “Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components.” During the audit and review, the project team asked the applicant to clarify the selection of locations for monitoring. In a letter dated July 1, 2005, the applicant elaborates on the selection of locations for monitoring. It also states that any locations that are more limiting than those identified in NUREG/CR-6260 will also be addressed. The project team finds this acceptable.

In the PNP LRA, the applicant also discusses preventive action and parameters monitored elements of the Fatigue Monitoring Program. In a letter dated July 1, 2005, the applicant confirms that non-design-basis transients will be addressed prior to the period of extended operation. As appropriate, allowable cycle counts will be determined or the cumulative usage factor calculations will be updated if necessary to maintain a cumulative usage factor (CUF) <1.0 as required by the ASME Code. The project team finds this acceptable.

In the PNP LRA discussion of the monitoring and trending program element, the applicant states that running totals of cumulative fatigue usage at each monitored location are available on demand. In a letter dated July 1, 2005, the applicant states that the minimum frequency for determination of the CUF will be once per refueling cycle. The project team finds this acceptable.

The project team reviewed the other portions of the Fatigue Monitoring Program for which the applicant claims consistency with GALL AMP X.M1 and finds 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 failure due to fatigue damage will be prevented. The project team finds the applicant's Fatigue Monitoring Program acceptable because it conforms to the recommended GALL AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary."

2.19.3 Exceptions to the GALL Report

None

2.19.4 Enhancements

The applicant states, in the PNP LRA, that a Fatigue Monitoring Program will be developed and implemented. Features of the program will include monitoring and tracking of selected cyclic loading transients (cycle counting) and their effects on critical reactor pressure boundary components and other selected components.

In addition, the applicant states that the element descriptions describe the program as it will exist after it has been implemented. The program is scheduled to be implemented prior to the period of extended operation.

The project team finds this acceptable, since PNP committed to develop PNP AMP B3.2, "Fatigue Monitoring Program," to include monitoring and tracking of selected cyclic loading transients (cycle counting) and their effects on critical reactor pressure boundary components and other selected components. This is consistent with GALL AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary."

2.19.5 Operating Experience

In the PNP LRA the applicant states that PNP has a comprehensive Operating Experience Program (OEP) that monitors industry issues/events and assesses these for applicability to its own operations. In addition, the PNP Corrective Action Program (CAP) is used to track, trend and evaluate plant issues/events. Those issues and events, whether external or plant-specific, that are potentially significant to the Fatigue Monitoring Program at PNP will be evaluated. The Fatigue Monitoring Program will be augmented, as appropriate, if these evaluations show that program changes or monitoring of additional locations will enhance program effectiveness. Using the OEP and CAP to monitor and evaluate industry and plant operating experience ensures that Fatigue Monitoring Program issues are addressed in a timely manner and that age-related deterioration of SSCs within the scope of the Fatigue Monitoring Program will be effectively managed throughout the license renewal period.

PNP has been tracking and logging plant-specific transient cycles. The applicant reviewed plant-specific analytical results and transient logs for all tracked transients, as well as industry operating experience related to metal fatigue. The need for more rigorous cycle counting methodology has been identified and is to be implemented in the new program. Several specific issues were addressed in the PNP LRA, including

- charging or letdown flow termination and reinitiation
- pressurizer spray actuation
- pressurizer surge nozzle and the hot leg piping surge nozzle cycling
- thermal stratification at high pressure safety injection nozzles

If necessary to maintain the projected CUF <1.0 for these or other locations, stress-based fatigue monitoring will be implemented as part of the Fatigue Monitoring Program.

The project team reviewed the operating experience provided in the PNP LRA, and interviewed the applicant's technical staff to confirm that the plant-specific operating experience revealed no degradation outside the bounds 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 concludes that the applicant's Fatigue Monitoring Program will adequately manage the aging effects that are identified in the PNP LRA for which this AMP is credited.

2.19.6 FSAR Supplement

The applicant provides its FSAR Supplement for the Fatigue Monitoring Program in PNP LRA, Appendix A, Section A3.2, which states that the Fatigue Monitoring Program is a new program that ensures that limits on fatigue usage are not exceeded during the renewal term. The program monitors and tracks selected cyclic loading transients (cycle counting) and their effects on susceptible components. PNP has selected this option under 10 CFR 54.21 to manage cracking due to metal fatigue of the reactor coolant pressure boundary during the period of extended operation.

In the FSAR Supplement, the applicant states that the Fatigue Monitoring Program provides cycle counting activities for confirming analytically derived cumulative usage values for applicable locations. Specific locations that may be subject to cyclic loading that could cause fatigue cracking are monitored using a computer-based monitoring program provided by EPRI, called FatiguePro. If warranted, other monitoring methods in addition to cycle counting may also be employed under this program to monitor specific locations. During the audit and review, the project team noted that the preventive measures program element as presented in the PNP LRA did not explicitly describe the preventive actions that would be applied to mitigate fatigue cracking. In a letter dated July 1, 2005, the applicant states that the cumulative usage factor would be updated for trending and evaluation. The project team finds this to be consistent with the GALL Report and therefore acceptable.

The commitment for the enhancement to develop PNP AMP B3.2 is contained in the applicant's March 22, 2005 letter to the NRC.

The project team reviewed the FSAR Supplement and enhancement commitment for PNP AMP B3.2, found that they are consistent with the GALL Report, and determined that the FSAR Supplement 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).

2.19.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those portions of the program for which the applicant claims consistency with the GALL Report are consistent with the GALL Report. 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 AMP being consistent with the GALL Report AMP to which it was compared. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

3.0 Aging Management Review Results

The project team's audit and review activities for the PNP AMRs and its conclusions regarding these reviews are documented in this section.

The project team determined that the 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 and determined that it adequately addresses the issues for which the GALL Report recommended further evaluation.

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

In PNP LRA Tables 3.X.2-Y, in addition to the notes, the applicant provided a summary of AMR results for the applicable systems, which included SCs, associated materials, environment, aging effect requiring management, and an AMP for each line-item. The notes describe how the information in the tables aligns with the information in the GALL Report. Those that are aligned with the GALL Report are assigned letters and are described below. Those defined by the applicant are assigned numbers and defined in the PNP LRA.

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

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

Note C indicates that the component for the AMR line-item is different, but consistent with the GALL Report for material, environment, and aging effect. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The project team concluded that the AMR line-item of the different component was applicable to the component under review.

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

Note E indicates that the AMR line-item is consistent with the GALL Report for material, environment, and aging effect, but a different AMP is credited. The project team evaluated these line-items to determine that the AMP credited by the applicant is applicable.

Note F indicates that the material is not in the GALL Report for the identified component.

Note G indicates that the environment is not in the GALL Report for the identified component and material.

Note H indicates that the aging effect is not in the GALL Report for component, material, and environment combination.

Note I indicates that the aging effect in the GALL Report for the identified component, material, and environment combination is not applicable.

Note J indicates that neither the identified component nor the material and environment combination is evaluated in the GALL Report.

Discrepancies or issues 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 SER related to the PNP

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 PNP LRA and program basis documents, which are available at the applicant's office, and through interviews with the PNP technical staff. On the basis of its audit and review, the project team found that the applicable aging effects were identified, the appropriate combination of materials and environments were listed, and acceptable AMPs were specified.

The AMR results of PNP LRA Sections 3.1 through 3.6 reviewed by the project team are provided in the following sections.

3.1 PNP LRA Section 3.1 - Aging Management of Reactor Coolant System

In PNP LRA Section 3.1, the applicant provided the results of its AMRs for the reactor coolant system.

In PNP LRA Tables 3.1.2-1 through 3.1.2-4, the applicant provided a summary of the AMR results for component types associated with the (1) primary coolant system; (2) reactor vessel; (3) reactor vessel internals; and (4) replacement steam generators. The summary information for each component type included intended function; material; environment; aging effect requiring management; AMPs; the GALL Report Volume 2 item; cross reference to PNP LRA Table 3.1.1 (Table 1); as well as generic and plant-specific notes related to consistency with the GALL Report.

For each component type in PNP LRA Table 3.1.1, the applicant identified those component types that are managed in a manner consistent with the GALL Report, component types for which the GALL Report recommends further evaluation, and those AMRs that are not addressed in the GALL Report together with the method proposed for their aging management.

The project team conducted its audit and review in accordance with SRP-LR Section 3.1.3 and the PNP audit and review plan. The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report, including LR-AMR-PCS, "Primary Coolant System," LR-AMR-RVG, "Reactor Vessel," LR-AMR-RVI, "Reactor Vessel Internals," and LR-AMR-RSG, "Replacement Steam Generators."

3.1.1 Aging Management Review Results That Are Consistent with the GALL Report

For aging management evaluations that the applicant states are consistent with the GALL Report, the project team conducted its audit and review to determine if the applicant's reference to the GALL Report in the PNP LRA is acceptable.

The project team reviewed its assigned PNP LRA line-items to determine that the applicant (1) provides a brief description of the system, components, materials, and environment; (2) states that the applicable aging effects have been reviewed and are evaluated in the GALL Report; and (3) identifies those aging effects for the primary coolant system, reactor vessel, reactor vessel internals, and replacement steam generator components that are subject to an AMR.

The following subparagraphs identify differences, when compared to the GALL Report, that were identified by the project team during the audit and review.

3.1.1.1 Loss of Material Due to Pitting and Crevice Corrosion

In the discussion section of Table 3.1.1, Item 3.1.1-02 of the PNP LRA, the applicant states that PNP AMP B2.1.2, "ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program" (ISI Program) and B2.1.21, "Water Chemistry Program" are used to manage loss of material due to pitting and crevice corrosion. In Table 3.1.2-4, the applicant states that these programs will be applied to the feedwater inlet nozzles and thermal sleeves.

The GALL Report recommends the use of programs consistent with GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," and GALL AMP XI.M2, "Water Chemistry" to manage this aging effect.

The project team evaluations of the ISI and Water Chemistry Programs are documented in Sections 2.2 and 2.17, respectively, of this audit and review report. If it is determined that thermal sleeves should remain within the scope of license renewal, pitting and crevice corrosion are adequately managed.

The project team's review of LRA Table 3.1.1, Item 3.1.1-02 identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the project team's RAI as discussed below.

RAI 3.1.1-1. During the project team's LRA audit and review, it was not apparent how the applicant intended to manage thermal sleeve aging effects. The RAI requested the applicant to provide information on how it plans to manage aging of thermal sleeves.

In its response, dated July 1, 2005, the applicant states that thermal sleeves do not serve an intended function and for that reason they do not require aging management. The applicant's response is a change to the components that are screened into the LRA and is therefore outside of the audit and review scope performed by the project team. Dispositioning of this RAI is within the scoping and screening activities performed by DSSA. The disposition of RAI 3.1.1-1 by DSSA is documented in Section 2 of the SER related to the PNP LRA. **[This is Confirmatory Item CI-3.1.1-1.]**

The project team finds that, predicated on DSSA accepting the applicant's response to RAI 3.1.1-1 **[Confirmatory Item CI-3.1.1-1]**, the applicant's proposed use of its ISI and Water Chemistry Programs to manage pitting and crevice corrosion in the steam generator to be consistent with the GALL Report and therefore acceptable.

3.1.1.2 Crack Initiation and Growth Due to Thermal and Mechanical Loading or SCC of Small-Bore Piping < 4" NPS

In the discussion section of Table 3.1.1, Item 3.1.1-07 of the PNP LRA, the applicant states that crack initiation and growth due to thermal and mechanical loading or SCC of small-bore piping will be managed using PNP AMPs B2.1.2, “ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program,” and B2.1.21, “Water Chemistry Program.”

The GALL Report recommends the use of a program consistent with GALL AMP XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD;” GALL AMP XI.M2, “Water Chemistry;” and GALL AMP XI.M32, “One-Time Inspection.”

In a letter dated August 27, 2005 (ML052440392), the applicant states that it would also use PNP AMP B2.1.13, “One-Time Inspection Program,” to manage aging of all components of the primary coolant system handled according to this Table 1 item (Item 3.1.1-07). The project team finds this to be consistent with the GALL Report and therefore acceptable.

In PNP LRA Table 3.3.2-1, the applicant also states that stainless steel flow elements, pipe, and pressure test fittings of the CVCS are managed using the Water Chemistry, ISI, and One-Time Inspection Programs. The project team finds this to be consistent with the GALL Report and therefore acceptable.

In the PNP LRA, the applicant also associated this Table 1 item with the stainless steel reactor head vent and flow elements in the CVCS. For these components, loss of material was identified as an aging effect to be managed using the applicant’s Water Chemistry and ISI Programs. In a letter dated August 27, 2005, the applicant states that loss of material is not an applicable aging effect for stainless steel in treated water.

The project team concurs that loss of material from stainless steel in treated water does not require aging management because the aging effect is not present.

3.1.1.3 Wall Thinning Due to Flow-Accelerated Corrosion

In the discussion section of Table 3.1.1, Item 3.1.1-25 of the PNP LRA, the applicant states that PNP AMP B2.1.11, "Flow Accelerated Corrosion Program" is used to manage wall thinning due to flow-accelerated corrosion (FAC) acting on feedwater inlet nozzles and thermal sleeves.

The GALL Report recommends the use of a program consistent with GALL AMP XI.M17, "Flow-Accelerated Corrosion," to manage aging of those steam generator components within the scope of license renewal that are also subject to FAC.

The project team evaluation of the Flow-Accelerated Corrosion Program is documented in Section 2.9 of this audit and review report. The project team confirmed that the thermal sleeves in question are addressed in the implementation of this program, so if it is determined that they should remain within the scope of license renewal, this aging effect is adequately managed.

The project team's review of LRA Table 3.1.1, Item 3.1.1-02 identified an area in which additional information was necessary to complete the review of the applicant's scoping and screening results. The applicant responded to the project team's RAI as discussed below.

RAI 3.1.1-1. During the project team's LRA audit and review, it was not apparent how the applicant intends to manage thermal sleeve aging effects. The RAI requested the applicant to provide information on how it plans to manage aging of thermal sleeves.

In its response, dated July 1, 2005, the applicant states that thermal sleeves do not serve an intended function and for that reason they do not require aging management. The applicant's response is a change to the components that are screened into the LRA and is therefore outside of the audit and review scope performed by the Project Team. Dispositioning of this RAI is within the scoping and screening activities performed by DSSA. The disposition of RAI 3.1.1-1 by DSSA is documented in Section 2 of the SER related to the PNP LRA. **[This is Confirmatory Item CI-3.1.1-1.]**

The project team finds the applicant's proposed use of its Flow-Accelerated Corrosion Program to be consistent with the GALL Report and therefore acceptable.

3.1.1.4 Crack Initiation and Growth Due to Cyclic Loading, and/or SCC, and PWSCC

In the discussion section of Table 3.1.1, Item 3.1.1-36 of the PNP LRA, the applicant states that three programs are used to manage crack initiation and growth due to cyclic loading, stress corrosion cracking (SCC), and primary water stress corrosion cracking (PWSCC). These are PNP AMPs B2.1.1, “Alloy 600 Program,” B2.1.2, “ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program,” (ISI Program) and B2.1.21, “Water Chemistry Program.” However, in no instance does the applicant apply all three of these AMPs to manage this aging effect. In PNP LRA Table 3.1.2-1, only the Alloy 600 and Water Chemistry Programs are identified to manage these aging mechanisms for Alloy 600/690 safe ends. To manage cast austenitic stainless steel (CASS) valve bodies and pump casings, only the ISI and the Water Chemistry Programs are identified.

The GALL Report recommends management of this aging mechanism for safe ends using programs consistent with GALL AMPs XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” and XI.M2, “Water Chemistry.” However, for nozzles of nickel-alloy (Item 3.1.1-35), the GALL Report states that a program consistent with GALL AMP XI.M11, “Nickel-Alloy Nozzles and Penetrations,” is acceptable, and does not identify SCC as an aging effect requiring management.

The project team finds that the Alloy 600 and Water Chemistry Programs are appropriate for managing crack initiation and growth in the nickel-alloy safe ends, are consistent with the GALL Report, and are therefore acceptable.

Similarly, for CASS components, the GALL Report recommends an AMP consistent with GALL AMP XI.M12, “Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS),” which explicitly states that for pump casings and valve bodies, a program consistent with GALL AMP XI.M1 is sufficient.

On this basis, the project team finds that the use of ISI and Water Chemistry Programs for managing crack initiation and growth in the CASS pumps and valves is consistent with the GALL Report and therefore acceptable.

Finally, crack initiation and growth in stainless steel components of the primary coolant, reactor vessel, and chemical and volume control systems exposed to treated (borated) water are managed using both ISI and Water Chemistry Programs, which is consistent with the GALL Report and therefore acceptable to the project team.

On the basis of its review, the project team finds that the applicant appropriately addressed crack initiation and growth due to cyclic loading, and/or SCC, and PWSCC as recommended by the GALL Report.

3.1.1.5 Loss of Material Due to Boric Acid Corrosion

In the discussion section of Table 3.1.1, Item 3.1.1-38 of the PNP LRA, the applicant states that PNP AMP B2.1.4, “Boric Acid Corrosion Program,” is used to manage loss of material due to boric acid corrosion. In PNP LRA Tables 3.1.2-1 and 3.1.2-2, the Boric Acid Corrosion Program is augmented with PNP AMP B2.1.3, “Bolting Integrity Program,” for low-alloy and stainless steel bolting and fasteners exposed to air.

The GALL Report recommends management of this aging effect using a program consistent with GALL AMP XI.M10, “Boric Acid Corrosion.”

The project team finds that augmenting the Boric Acid Corrosion Program with the Bolting Integrity Program (for fasteners) exceeds the recommendations of the GALL Report and is therefore acceptable to the project team.

In PNP LRA Table 3.1.2-1, the applicant states that the epoxy-coated carbon steel of the pressurizer quench tank is exposed to containment air and treated water and proposes to manage loss of material from this surface using PNP AMP B2.1.20, “System Monitoring Program,” augmented with PNP AMP B2.1.13, “One-Time Inspection Program.” The PNP FSAR states that the tank normally contains nitrogen and demineralized water. In the course of normal operation, borated water is introduced as well.

During the audit and review, the project team requested that the applicant clarify the nature of the pressurizer quench tank interior environment and justify the application of its System Monitoring Program and One-Time Inspection Program to manage loss of material for these environments. The applicant has not yet provided a response. RAI-3.1.2-1(a) has been written to clarify the pressurizer quench interior environment. **[This is RAI-3.1.2-1(a)]**.

3.1.1.6 Crack Initiation and Growth Due to SCC, PWSCC, and/or IASCC

In the discussion section of Table 3.1.1, Item 3.1.1-44 of the PNP LRA, the applicant states that PNP AMP B2.1.2, “ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program,” and PNP AMP B2.1.21, “Water Chemistry Program” are used to manage crack initiation and growth due to SCC, PWSCC, and IASCC.

In PNP LRA Table 3.1.2-1, the applicant proposes to use the PNP AMPs B2.1.1, “Alloy 600 Program,” and B2.1.21, “Water Chemistry Program” to manage this aging effect for Alloy 600 cladding of the primary coolant system. This is not consistent with PNP LRA Table 3.1.1, Item 3.1.1-44.

The GALL Report recommends management of crack initiation and growth for safe ends using programs consistent with GALL AMPs XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” (ISI Program) and XI.M2, “Water Chemistry.” However, for nozzles of nickel-alloy (PNP LRA Table 3.1.1, Item 3.1.1-35), the GALL Report states that a program consistent with GALL AMP XI.M11, “Nickel-Alloy Nozzles and Penetrations,” is acceptable for management of cracking due to PWSCC.

On the basis that the programs listed in PNP LRA Table 3.1.2-1 are consistent with the GALL Report and that the GALL Report does not suggest that SCC or IASCC require aging management in Alloy 600 cladding, the project team finds aging management of crack initiation and growth of this component type to be consistent with the GALL Report and therefore acceptable.

In PNP LRA Table 3.1.2-4, the applicant proposes to use only its Water Chemistry Program to manage crack initiation and growth in the stainless steel manway cover diaphragm and the primary divider plate components of the replacement steam generator.

On the basis that the primary divider plate is subject only to the differential pressure across the steam generator and is not intended to perform a system fluid pressure boundary function, the project team finds it acceptable that the applicant manage crack initiation and growth in the divider plate using only its Water Chemistry Program.

The project team asked the applicant to justify the use of only its Water Chemistry Program to manage this aging affect for the steel manway cover. In a letter dated August 27, 2005, the applicant states that the stainless steel manway cover component type will be managed using the ISI Program in addition to the Water Chemistry Program. The project team finds this to be consistent with the GALL Report and therefore acceptable.

On the basis of its review, the project team finds that the applicant addressed crack initiation and growth due to SCC, PWSCC, and IASCC as recommended by the GALL Report.

3.1.1.7 Crack Initiation and Growth Due to SCC and IASCC

In the discussion section of Table 3.1.1, Item 3.1.1-45 of the PNP LRA, the applicant states that PNP AMP B2.1.17, "Reactor Vessel Internals Inspection Program," and PNP AMP B2.1.21, "Water Chemistry Program" are used to manage crack initiation and growth due to SCC and IASCC. In PNP LRA Table 3.1.2-3, the applicant proposes to use only the Reactor Vessel Internals Inspection Program to manage this aging effect in the stainless steel spacer shim and instrument sleeve. During the audit and review, the project team asked the applicant to justify this approach.

In a letter dated August 27, 2005, the applicant states that the stainless steel spacer shim and instrument sleeve will be managed using the Water Chemistry Program in addition to the Reactor Vessel Internals Inspection Program. The project team finds this to be consistent with the GALL Report and therefore acceptable.

On the basis of its review, the project team finds that management of crack initiation and growth due to SCC and IASCC is consistent with the GALL Report and therefore acceptable.

3.1.1.8 Loss of Preload

In the discussion section of Table 3.1.1, Item 3.1.1-48 of the PNP LRA, the applicant states that PNP AMP B2.1.2, "ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program," is used to manage loss of preload due to stress relaxation.

The GALL Report recommends management of loss of preload using programs consistent with GALL AMPs XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD" and XI.M14, "Loose Part Monitoring."

During the audit and review, the project team asked the applicant to clarify how the GALL Report recommendation is satisfied. The applicant pointed out that GALL AMP XI.M14 would not be effective until failure of components had occurred. Inspection in accordance with examination category B-N-3 of the ASME Code, Section XI, Subsection IWB includes VT-3 examinations of bolted connections to detect a gross loss of preload, such as looseness or improper fit.

In a letter dated August 27, 2005, the applicant revises the characterization of aging management for this aging mechanism to note that the program used is not identical to the combination of programs recommended in the GALL Report.

On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of preload due to stress relaxation is effectively managed using the applicant's ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program. On this basis, the project team finds that for components of the reactor coolant systems, management of loss of preload due to stress relaxation is acceptable.

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 finds that all other AMR results that the applicant identified as consistent with the GALL Report are consistent with the AMRs in the GALL Report. Therefore the project team finds 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 Aging Management Review Results for Which Further Evaluation Is Recommended by the GALL Report

For some line-items assigned to the project team in PNP LRA Tables 3.1.2-1 through 3.1.2-4, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in PNP LRA Section 3.1.2.2 against the criteria provided in 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 line-item in Section 3.1 that includes a reference to the item in Table 1 for which further evaluation is recommended.

3.1.2.1 Cumulative Fatigue Damage (PNP LRA Section 3.1.2.2.1)

PNP LRA Section 3.1.2.2.1 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 TLAA is reviewed by the NRR DE staff. The evaluation of this TLAA will be addressed separately in Section 4 of the SER related to the PNP LRA.

3.1.2.2 Loss of Material Due to Pitting and Crevice Corrosion (PNP LRA Section 3.1.2.2.2)

3.1.2.2.1 Loss of Material Due to Pitting and Crevice Corrosion in Steam Generator Shell Assembly (PNP LRA Section 3.1.2.2.2.1)

The project team reviewed PNP 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 states that loss of material due to pitting and crevice corrosion could occur in the steam generator shell assembly. The existing program relies on control of chemistry to mitigate corrosion and ISI to detect loss of material. The extent and schedule of the existing steam generator inspections are designed to ensure that flaws cannot attain a depth sufficient to threaten the integrity of the welds. However, according to NRC Information Notice (IN) 90-04, if general corrosion pitting of the shell exists, the program may not be sufficient to detect pitting and corrosion.

In PNP LRA Section 3.1.2.2.2.1, the applicant addresses loss of material in the steam generator shell assembly due to pitting and crevice corrosion. The PNP LRA states that the concerns of IN 90-04 are not applicable to PNP since the steam generators were replaced in 1990 and pitting corrosion of the steam generator shell is not known to currently exist.

The applicant credits its Water Chemistry Control Program and its Inservice Inspection Program for managing loss of material due to pitting and crevice corrosion on the internal surfaces of the steam generator shell, and recommends using the Steam Generator Tube Integrity Program to manage pitting and crevice corrosion. The Steam Generator Tube Integrity Program incorporates the guidance of NEI 97-06, "Steam Generator Program Guidelines" (January 2001) to verify the integrity of the secondary-side internal surfaces of the steam generators. A combination of the Water Chemistry Program, ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program, and the Steam Generator Tube Integrity Program are used to manage this aging effect.

The project team's review of PNP LRA Section 3.1.2.2.2 identified an area in which additional information was necessary to complete the review of the applicant's AMR review results. The applicant responded to the project team's RAI as discussed below.

RAI-3.1.2.2.2-1. The PNP LRA states that an augmented inspection for steam generator shell assemblies for loss of material due to pitting/crevice corrosion is not applicable for PNP. NUREG-1801, "Generic Aging Lessons Learned (GALL) Report" recommends such augmented inspection based on industry experience and extended exposure of the shell material to the water environment. Please provide technical justification for the determination.

In its response, dated July 1, 2005, the applicant states that Section 3.1.2.2.2 of the SRP-LR states that loss of material due to pitting and crevice corrosion could occur in the steam generator shell assembly. The existing program relies on control of water chemistry to mitigate corrosion, and inservice inspection to detect the loss of material. The extent and schedule of the existing steam generator inspections ensure that flaws cannot attain a depth sufficient to threaten the integrity of the welds. However, the NRC states in NRC IN 90-04, "Cracking of the Upper Shell-to-Transition Cone Girth Welds in Steam Generators," dated January 26, 1990, if pitting and crevice corrosion of the shell exists, the program may not be sufficient to detect pitting and corrosion. The GALL Report recommends augmented inspections to manage this aging effect.

In addition, to its response of RAI-3.1.2.2.2-1, the applicant states in Section 3.1.2.2.2.1 of the PNP LRA, that pitting/crevice corrosion is not known to exist in the steam generator shells, and, therefore, augmented inspections are not necessary. This statement was based upon the following operating experience: (1) in February of 2000, the steam generator program engineer, who was also a certified welding inspector, completed a 360 degree walk down of the secondary side internal wall, at the elevation of the main feedwater ring. During that walk down no evidence of ID pitting was identified; and (2) during the 2003 refueling outage, 2 complete steam generator shell circumferential welds were examined from the OD using volumetric inspection techniques. These weld inspections did not identify evidence of internal pitting in the associated steam generator shell area.

Furthermore, in its response to RAI-3.1.2.2.2-1, the applicant states that the original PNP steam generators were replaced in 1990 with Combustion Engineering Model 2530 steam generators. Since then, PNP has maintained secondary water chemistry in accordance with EPRI guidelines. The combination of these factors, coupled with continued water chemistry maintenance and ISI inspections provides reasonable assurance that pitting/crevice corrosion will not threaten the steam generator shell pressure boundary function during the period of extended operation. This is consistent with the project team’s conclusions in past SERs, including the SER for Plant Farley (NUREG-1825).

Based on the above discussion, the project team finds the applicant’s response to RAI-3.1.2.2.2-1 is acceptable because the applicant has provided an acceptable case for not needing augmented inspections, supported by operating experience. The project team’s concern described in RAI-3.1.2.2.2-1 is resolved.

During the audit and review, the project team interviewed the applicant’s technical staff and reviewed the most recent steam generator inspection records. The project team confirmed that these records documented the absence of pitting and crevice corrosion. On this basis, the project team finds that the applicant has met the criteria of SRP-LR Section 3.1.2.2.2.1 for further evaluation.

The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement (PNP LRA Section 3.1.2.2.3)

3.1.2.3.1 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement - TLAA Evaluation (PNP LRA Section 3.1.2.2.3.1)

PNP LRA Section 3.1.2.2.3.1 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 TLAA is reviewed by the NRR DE staff. The evaluation of this TLAA will be addressed separately in Section 4 of the SER related to the PNP LRA.

3.1.2.3.2 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement - Reactor Vessel Materials Surveillance Program (PNP LRA Section 3.1.2.2.3.2)

PNP LRA Section 3.1.2.2.3.2 is reviewed by the NRR DE staff and will be addressed separately in Section 3 of the SER related to the PNP LRA.

3.1.2.3.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement (PNP LRA Section 3.1.2.2.3.3)

The project team reviewed PNP LRA Section 3.1.2.2.3.3 against the criteria in SRP-LR Section 3.1.2.2.3.3.

SRP-LR Section 3.1.2.2.3.3 states that loss of fracture toughness due to neutron irradiation embrittlement and void swelling could occur in Westinghouse and Babcock and Wilcox (B&W) baffle/former bolts. The GALL Report recommends further evaluation to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of the SRP-LR).

In the PNP LRA, the applicant states that this issue is not applicable and that PNP is a Combustion Engineering PWR that does not have a baffle/former bolt configuration. By letter dated August 27, 2005, the applicant clarified the basis for the conclusion that embrittlement of the bolts is not a concern at PNP. Although the plant uses baffle/former bolts, the material used in these bolts is annealed 316 stainless steel. The applicant states that the stresses on the bolts are significantly lower: the bolt stress from preload is a smaller percentage of yield strength; the differential pressure across the core shroud panels does not produce large tensile loads on the baffle/former bolts during normal operation; and the core shroud panel design allows for some flexing of the former plate relative to the core barrel.

The project team reviewed evaluations performed by the reactor vendor and confirmed that the PNP baffle-former bolts are of annealed 316 stainless steel. This material is significantly less brittle than the cold-worked 316 stainless steel or other materials used in designs where this aging mechanism has been observed. In addition, the loading of these fasteners is low enough to obviate the concern. On this basis, the project team finds that for the PNP baffle-former bolts, loss of fracture toughness due to irradiation embrittlement does not require aging management.

3.1.2.4 Crack Initiation and Growth Due to Thermal and Mechanical Loading or SCC (PNP LRA Section 3.1.2.2.4)

3.1.2.4.1 Crack Initiation and Growth Due to Thermal and Mechanical Loading or SCC of Small-Bore Piping < 4" NPS (PNP LRA Section 3.1.2.2.4.1)

The project team reviewed PNP 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 crack initiation and growth due to thermal and mechanical loading or SCC (including intergranular stress corrosion cracking [IGSCC]) could occur in small-bore reactor coolant system and connected system piping smaller than NPS 4. The existing program relies on control of water chemistry to mitigate SCC and ASME Section XI

ISI to detect it. The GALL Report recommends that a plant-specific destructive examination or a NDE that permits inspection of the inside surfaces of the piping be conducted to ensure that cracking has not occurred and the component intended function will be maintained during the extended period. The AMPs should be augmented by verifying that service induced weld cracking is not occurring in the small-bore piping less than NPS 4, including pipe, fittings, and branch connections. A one-time inspection of a sample of locations is an acceptable method to ensure that the aging effect is not occurring and the component's intended function will be maintained during the period of extended operation.

In PNP LRA Section 3.1.2.2.4.1, the applicant addresses crack initiation and growth of the small-bore reactor coolant system and connected system piping less than NPS 4 due to SCC, intergranular SCC and thermal and mechanical loading. The PNP LRA states that at PNP, crack initiation and growth due to SCC was identified as an aging effect/mechanism requiring management in small-bore (less than NPS 4) primary coolant system piping and branch lines. Aging management of service-induced cracking will be accomplished by a combination of the Water Chemistry Program and the ASME Section XI, Subsections IWB, IWC, and IWD Inservice Inspection Program (ISI Program). In addition, inspections of a sample of small bore PCS piping will be performed.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.4.1 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.5 <u>Crack Growth Due to Cyclic Loading (PNP LRA Section 3.1.2.2.5)</u>

PNP LRA Section 3.1.2.2.5 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 TLAA is reviewed by the NRR DE staff. The evaluation of this TLAA will be addressed separately in Section 4 of the SER related to the PNP LRA.

3.1.2.6 <u>Changes in Dimension Due to Void Swelling (PNP LRA Section 3.1.2.2.6)</u>

The project team reviewed PNP 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 changes in dimension due to void swelling could occur in reactor internal components. The GALL Report recommends further evaluation to ensure that this aging effect is adequately managed. The reactor vessel internals receive a visual inspection (VT-3) according to Category B-N-3 of Subsection IXB, ASME Section XI. This inspection is not sufficient to detect the effects of changes in dimension due to void swelling. The GALL Report recommends that a plant-specific aging management program should be evaluated. The applicant is to provide a plant-specific AMP, participate in industry programs to investigate aging effects and determine the appropriate AMP, provide the basis for concluding that void swelling is not an issue, or provide a program to manage the effects of changes in dimension due to void swelling and the loss of ductility associated with swelling.

In PNP LRA Section 3.1.2.2.6, the applicant addresses changes in dimension of reactor internals due to void swelling. The PNP LRA states that industry activities are underway to determine whether changes in dimension due to void swelling is an aging effect requiring management for license renewal. PNP continues to participate in industry investigations of aging effects applicable to reactor vessel internals, as well as initiatives to develop and qualify methods for detection and management. PNP will incorporate applicable results of industry initiatives related to void swelling in the Reactor Vessel Internals Inspection Program.

The project team reviewed the applicant's further evaluation and concluded that it is consistent with the SRP-LR.

The project team finds that, based on the program and commitment identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.6 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.7 Crack Initiation and Growth Due to SCC or PWSCC (PNP LRA Section 3.1.2.2.7)

3.1.2.7.1 Crack Initiation and Growth Due to SCC or PWSCC (PWR Components) (PNP LRA Section 3.1.2.2.7.1)

The project team reviewed PNP 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 crack initiation and growth due to SCC and PWSCC could occur in PWR core support pads (or core guide lugs), instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the steam generator instruments and drains. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed. The GALL Report recommends that a plant-specific aging management program be evaluated because existing programs may not be capable of mitigating or detecting crack initiation and growth due to SCC. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of the SRP-LR).

In PNP LRA Section 3.1.2.2.7.1, the applicant addresses crack initiation and growth of PWR core support pads, instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the steam generator instruments and drains due to SCC and/or PWSCC. The PNP LRA states that this grouping includes the surge nozzle thermal sleeve, safety injection nozzle thermal sleeve, charging inlet nozzle thermal sleeve, resistance temperature detectors (RTD) nozzles, pressure measurement nozzle, sampling nozzle, and partial nozzle replacement. Reactor vessel items included in this grouping are the lower shell and bottom head cladding, surveillance capsule holders, core stabilizing lugs, core stop and support lugs, and the flow baffle and skirt, the reactor head O-ring, leakoff tubing and valves. Steam generator items included in this grouping are the tube plate cladding, channel head divider plate, and primary nozzle closure rings. Refer to Item 3.1.1-44 of Table 3.1.1 in the PNP LRA for the primary side steam generator items. EPRI Material Reliability Program (MRP) in conjunction with the PWR owners groups is developing a strategic plan to manage and mitigate cracking of nickel-based alloy items. The guidance developed by the MRP will be used to identify critical locations for inspection and to augment existing ISI inspections at PNP, as appropriate. The results of the strategic plan will be incorporated into the Alloy 600 Program and, as applicable, the Water Chemistry Program and the ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program.

The project team's review of PNP LRA Section 3.1.2.2.7.1 identified an area in which additional information was necessary to complete the review of the applicant's AMR review results. The applicant responded to the project team's RAI as discussed below.

RAI-3.1.2.2.7.2-1. The AMP for cast austenitic stainless steel (CASS) thermal embrittlement in the PNP LRA does not include a flaw tolerance evaluation or enhanced volumetric inspection as recommended in the GALL Report. Please clarify and discuss this basis.

In its response, dated July 1, 2005, the applicant states that in Section B2.0 of the PNP LRA, PNP does not have a GALL XI.M12 AMP for CASS. PNP has no CASS material in the primary coolant system other than valve bodies and pump casings which are managed under the applicant's ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program discussed in PNP LRA Section B2.1.2.

Based on the above discussion, the project team finds the applicant's response to RAI-3.1.2.2.7.2-1 acceptable because the PNP has no CASS material in the primary coolant system other than valve bodies and pump casings which are effectively managed using its ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program. The project team's concern described in RAI-3.1.2.2.7.2-1 is resolved.

The project team reviewed the applicant's further evaluation and concluded that it is consistent with the SRP-LR.

The project team finds that, based on the programs and commitment identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.7.1 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.7.2 Crack Initiation and Growth Due to SCC or PWSCC (CASS Components) (PNP LRA Section 3.1.2.2.7.2)

The project team reviewed PNP 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 crack initiation and growth due to SCC could occur in PWR cast austenitic stainless steel (CASS) reactor coolant system piping and fittings and pressurizer surge line nozzle. The GALL Report recommends further evaluation of piping that does not meet either the reactor water chemistry guidelines of TR-105714 or material guidelines of NUREG-0313. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of the SRP-LR).

In PNP LRA Section 3.1.2.2.7.2, the applicant addresses crack initiation and growth of CASS reactor coolant system piping due to SCC. The PNP LRA states that there is no CASS piping and that only the primary coolant pump casing and the valve bodies of power-operated relief valve (PORV) isolation valves are fabricated of CASS. The PNP Water Chemistry Program and the ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program are used to manage this aging effect. The Water Chemistry Program meets the EPRI reactor water chemistry guideline TR-105714. As discussed in the respective sections of Appendix B of the PNP LRA, each of these programs provides reasonable assurance that the aging effect will be managed such that the SSCs within the scope of each program will continue to perform their intended functions consistent with the current licensing bases for the period of extended operation.

The project team reviewed the applicant's further evaluation and concluded that it is consistent with the SRP-LR.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.7.2 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.7.3 Crack Initiation and Growth Due to SCC or PWSCC (Ni Alloys) (PNP LRA Section 3.1.2.2.7.3)

The project team reviewed PNP LRA Section 3.1.2.2.7.3 against the criteria in SRP-LR Section 3.1.2.2.7.3.

SRP-LR Section 3.1.2.2.7.3 states that crack initiation and growth due to PWSCC could occur in pressurizer instrumentation penetrations and heater sheaths and sleeves made of Ni alloys. The existing program relies on ASME Section XI ISI and on control of water chemistry to mitigate PWSCC. However, the existing program should be augmented to manage the effects of SCC on the intended function of Ni-alloy components. The GALL Report recommends that the applicant provide a plant-specific AMP or participate in industry programs to determine appropriate AMP for PWSCC of Inconel 182 weld. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of the SRP-LR).

In PNP LRA Section 3.1.2.2.7.3, the applicant addresses crack initiation and growth of pressurizer instrumentation penetrations and heater sheaths and sleeves made of Ni-alloys due to PWSCC. The PNP LRA states that nickel-based alloy material is identified for the pressurizer instrumentation nozzles, heater sheaths and sleeves, and thermal sleeves. PNP pressurizer components included in this grouping are the instrument nozzles, electric heaters (penetration nozzles and plugs, original heater sheath, heater sleeve, and end plugs). The programs credited for the management of PWSCC of these nickel-based alloy items are the Alloy 600 Program and Water Chemistry Program, supplemented by the ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program.

As described in PNP LRA Section 3.1.2.2.7.1, the applicant's Alloy 600 Program includes participation in industry programs to identify critical locations for inspection and augment existing ISI inspections at PNP where appropriate. PNP has had several instances of SCC in Alloy 600 welds and heat affected zones, some of which resulted in through wall leaks.

The project team reviewed the applicant's further evaluation and concluded that it exceeds the requirements of the SRP-LR.

The project team finds that, based on the programs and commitment identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.7.3 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.8 Crack Initiation and Growth Due to SCC or IASCC (PNP LRA Section 3.1.2.2.8)

The project team reviewed PNP LRA Section 3.1.2.2.8 against the criteria in SRP-LR Section 3.1.2.2.8.

SRP-LR Section 3.1.2.2.8 states that crack initiation and growth due to SCC or IASCC could occur in baffle/former bolts in Westinghouse and B&W reactors.

In PNP LRA Section 3.1.2.2.8, the applicant addresses crack initiation and growth of Westinghouse and B&W baffle former bolts due to SCC and IASCC. The PNP LRA states that the PNP reactor vessel internals do not include baffle/former bolts. By letter dated August 27, 2005, the applicant clarified the basis for the conclusion that embrittlement of the bolts is not a concern at PNP. Although the plant uses baffle/former bolts, the material used in these bolts is annealed 316 stainless steel. The applicant states that the stresses on the bolts are significantly lower: the bolt stress from preload is a smaller percentage of yield strength; the differential pressure across the core shroud panels does not produce large tensile loads on the baffle/former bolts during normal operation; and the core shroud panel design allows for some flexing of the former plate relative to the core barrel.

The project team reviewed evaluations performed by the reactor vendor and confirmed that the PNP baffle-former bolts are of annealed 316 stainless steel. This material is significantly less brittle than the cold-worked 316 stainless steel or other materials used in designs where this aging mechanism has been observed. In addition, the loading of these fasteners is low enough to obviate the concern. On this basis, the project team finds that for the PNP baffle-former bolts, loss of fracture toughness due to irradiation embrittlement does not require aging management at PNP.

3.1.2.9 Loss of Preload Due to Stress Relaxation (PNP LRA Section 3.1.2.2.9)

The project team reviewed PNP 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 loss of preload due to stress relaxation could occur in baffle/former bolts in Westinghouse and B&W reactors.

The PNP LRA states that the PNP reactor vessel internals do not include baffle/former bolts. By letter dated August 27, 2005, the applicant clarified the basis for the conclusion that embrittlement of the bolts is not a concern at PNP. Although the plant uses baffle/former bolts, the material used in these bolts is annealed 316 stainless steel. The applicant states that the stresses on the bolts are significantly lower: the bolt stress from preload is a smaller percentage of yield strength; the differential pressure across the core shroud panels does not produce large tensile loads on the baffle/former bolts during normal operation; and the core shroud panel design allows for some flexing of the former plate relative to the core barrel.

The project team reviewed evaluations performed by the reactor vendor and confirmed that the PNP baffle-former bolts are of annealed 316 stainless steel. The loading of these fasteners is low enough to obviate the concern. On this basis, the project team finds that for the PNP baffle-former bolts, loss of preload due to stress relaxation does not require aging management at PNP.

3.1.2.10 Loss of Section Thickness Due to Erosion (PNP LRA Section 3.1.2.2.10)

The project team reviewed PNP 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 loss of section thickness due to erosion could occur in steam generator feedwater impingement plates and supports. 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 (Appendix A.1 of the SRP-LR).

In PNP LRA Section 3.1.2.2.10, the applicant addresses loss of section thickness of steam generator feedwater impingement plate and support due to erosion. The PNP LRA states that the PNP steam generators do not include impingement plates.

On the basis that PNP steam generators do not include impingement plates, the project team finds that loss of section thickness due to erosion of impingement plates does not require aging management at PNP.

3.1.2.11 Crack Initiation and Growth Due to PWSCC, ODSCC, or IGA or Loss of Material Due to Wastage and Pitting Corrosion or Loss of Section Thickness Due to Fretting and Wear or Denting Due to Corrosion of Carbon Steel Tube Support Plate (PNP LRA Section 3.1.2.2.11)

The project team reviewed PNP 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 crack initiation and growth due to PWSCC, ODSCC, or IGA or loss of material due to wastage and pitting corrosion or deformation due to corrosion could occur in Alloy 600 components of the steam generator tubes, repair sleeves and plugs. All PWR licensees have committed voluntarily to a SG degradation management program described in NEI 97-06; these guidelines are currently under NRC staff review. The GALL Report recommends that an AMP based on the recommendations of staff-approved NEI 97-06 guidelines, or other alternate regulatory basis for SG degradation management, should be developed to ensure that this aging effect is adequately managed.

In PNP LRA Section 3.1.2.2.11, the applicant addresses crack initiation and growth of (Alloy 600) steam generator tubes, repair sleeves, and plugs due to PWSCC, ODSCC, or IGA; loss of material of (Alloy 66) steam generator tubes, repair sleeves, and plugs due to wastage and pitting corrosion, and fretting and wear; or deformation due to corrosion at tube support plate intersections. The PNP LRA states that crack initiation and growth due to PWSCC, SCC, or IGA or loss of material due to wastage and pitting corrosion or deformation due to corrosion could occur in nickel-based alloy components of the steam generator tube plugs. To manage these aging effects, PNP credits the Steam Generator Tube Integrity Program supplemented by the Water Chemistry Program and the ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program. The Steam Generator Tube Integrity Program assessment of tube integrity and plugging or repair criteria of flawed tubes is in accordance with the plant technical specifications and NEI 97-06 guidelines. For general and pitting corrosion, the acceptance criteria are in accordance with NEI 97-06 guidelines.

The applicant also states that new, replacement recirculating steam generators were installed at PNP in 1990. These new steam generators incorporate many enhancements in design and materials of construction to minimize aging effects. However, cracking due to PWSCC and IGA/IGSCC and loss of material due to pitting and wear could occur in the PNP steam generator tubes and plugs.

In the same section, the applicant states that the Water Chemistry Program conforms to the guidelines in EPRI TR-105714 and TR-102134. The Water Chemistry Program mitigates aging effects such as cracking due to PWSCC and IGA/IGSCC and loss of material due to pitting and wear, by controlling the environment to which the steam generator tubes and plugs are exposed. These aging effects are minimized by controlling the chemical species that cause the underlying mechanisms that result in these aging effects. The program provides assurance that an elevated level of contaminants and oxygen does not exist in either the primary or secondary sides of the steam generators, and thus minimizes the occurrences of these aging effects. The Water Chemistry Program has maintained the desired primary and secondary water chemistry and detected abnormal conditions since initial plant operation. The applicant suggests that the Water Chemistry Program mitigates cracking due to PWSCC and IGA/IGSCC and loss of material due to pitting and wear in the steam generator tubes and plugs. Finally, the applicant states that verification of the effectiveness of the program will be performed to ensure that these aging effects are not occurring.

In addition, the applicant states, in the PNP LRA, that the Steam Generator Tube Integrity Program is used to manage these aging effects for the steam generator tubes and plugs in order to confirm the effectiveness of the Water Chemistry Program. The Steam Generator Tube Integrity Program was developed to meet the guidelines of NEI 97-06, “Steam Generator Program Guidelines” (January 2001). The program manages these aging effects through a balance of prevention, inspection, evaluation, repair, and leakage monitoring measures. Eddy current testing is used to detect steam generator tube flaws and degradation. Steam generator tubes not meeting the Technical Specification limits for continued operation are removed from service by installation of tube plugs. Tube plugs installed in the steam generators are fabricated from heat-treated Alloy 690 material. Although these plugs have a high resistance to PWSCC, they are routinely inspected as a part of the program. A tube integrity assessment is performed following each steam generator tube inspection to ensure that the performance criteria have been met for the previous operating period and will continue to be met for the next period.

The project team reviewed the applicant's further evaluation and concluded that it is consistent with the SRP-LR.

The project team finds 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 finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.12 Loss of Section Thickness Due to FAC (PNP LRA Section 3.1.2.2.12)

The project team reviewed PNP 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 loss of section thickness due to flow-accelerated corrosion could occur in tube support lattice bars made of carbon steel. The GALL Report recommends that a plant-specific aging management program be evaluated and, on the basis of the guidelines of NRC Generic Letter 97-06, an inspection program for steam generator internals be developed to ensure that this aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of the SRP-LR).

In PNP LRA Section 3.1.2.2.12, the applicant addresses loss of section thickness of tube support lattice bars made of carbon steel due to FAC. The PNP LRA states that the PNP steam generators do not include carbon steel tube support lattice bars. Therefore, loss of section thickness of these bars is not an applicable aging effect for PNP. On this basis, the project team finds that loss of section thickness of tube support lattice bars made of carbon steel does not require aging management at PNP.

3.1.2.13 Ligament Cracking Due to Corrosion (PNP LRA Section 3.1.2.2.13)

The project team reviewed PNP 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 ligament cracking due to corrosion could occur in carbon steel components in the steam generator tube support plate. All PWR licensees have committed voluntarily to a SG degradation management program described in NEI 97-06; these guidelines are currently under NRC staff review. The GALL Report recommends that an AMP based on the recommendations of staff-approved NEI 97-06 guidelines, or other alternate regulatory basis for SG degradation management, be developed to ensure that this aging effect is adequately managed.

In PNP LRA Section 3.1.2.2.13, the applicant addresses ligament cracking of the carbon steel tube support plate due to corrosion. The PNP LRA states that PNP steam generators have a carbon steel tube bundle support assembly but stainless steel eggcrate tube lattice support rings.

Because the PNP replacement steam generators incorporate an eggcrate tube lattice support, the project team finds that ligament cracking due to corrosion of the support plate does not require aging management at PNP.

The applicant also states that the Water Chemistry Program conforms to the guidelines in EPRI TR-105714 and TR-102134 and mitigates aging effects by controlling the environment to which the steam generator stainless steel tube support plates are exposed. The applicant states in the LRA that verification of the effectiveness of the program will be performed to ensure that this aging effect is not occurring.

In addition, the applicant states, in the PNP LRA, that the Steam Generator Tube Integrity Program is used to manage this aging effect for the steam generator stainless steel tube support plates in order to confirm the effectiveness of the Water Chemistry Program. The Steam Generator Tube Integrity Program was developed to meet the guidelines of NEI 97-06, “Steam Generator Program Guidelines” (January 2001). The program manages this aging effect through a balance of prevention, inspection, evaluation, repair, and leakage monitoring measures. Periodic visual inspections of accessible areas are performed to verify the integrity of secondary-side components, including the steam generator stainless steel tube support plates. A combination of the Water Chemistry Program and the Steam Generator Tube Integrity Program are used to manage this aging effect.

The project team reviewed the applicant's further evaluation and concluded that it is consistent with the SRP-LR.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.13 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.14 <u>Loss of Material Due to FAC (PNP LRA Section 3.1.2.2.14)</u>

The project team reviewed PNP 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 loss of material due to flow-accelerated corrosion could occur in feedwater inlet ring and supports. As noted in Combustion Engineering (CE) Information Notice (IN) 90-04 and NRC IN 91-19 and LER 50-362/90-05-01, this form of degradation has been detected only in certain CE System 80 steam generators. The GALL Report recommends further evaluation to ensure that this aging effect is adequately managed. The GALL Report recommends that a plant-specific aging management program be evaluated because existing programs may not be capable of mitigating or detecting loss of material due to flow-accelerated corrosion. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of the SRP-LR).

In PNP LRA Section 3.1.2.2.14, the applicant addresses loss of material of steam generator feedwater inlet ring and supports due to flow-accelerated corrosion. The PNP LRA states that the discussion in this paragraph of the SRP-LR is applicable to CE System 80 steam generators only, whereas PNP has Combustion Engineering Model 2530 steam generators.

In addition, the applicant determined that PNP steam generator feed rings do not perform any intended function that would make them subject to aging management. This position is evaluated by the NRC DSSA staff and documented in Section 2 of the SER related to the PNP LRA.

The project team reviewed the applicant's information in PNP LRA Section 3.1.2.2.14 and finds that because PNP does not have System 80 steam generators, loss of material due to flow-acceleration corrosion from the feedwater inlet rings and supports does not require aging management at PNP.

On this basis, the project team concludes that loss of material due to FAC in the feedwater inlet ring and supports does not require aging management at PNP.

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 these issues. For these items, the project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.3 Aging Management Review Results That Are Not Consistent with the GALL Report or Not Addressed in the GALL Report

In PNP LRA Tables 3.1.2-1 through 3.1.2-4, 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.

3.1.3.1 Reactor Coolant System AMR Line Items with No Aging Effect (PNP LRA Tables 3.1.2-1 through 3.1.2-4)

In PNP LRA Tables 3.1.2-1 through 3.1.2-4, no item was listed unless an aging effect requiring management had been identified through the aging management review process.

During the audit and review, the project team reviewed the AMR basis documents for reactor coolant systems. Specifically, the project team audited components having a material and environment combination for which no aging management program is recommended by the GALL Report. The project team found that every aging effect requiring management is reported in PNP LRA Tables 3.1.2-1 through 3.1.2-4. Furthermore, the project team finds that the intended functions of components within the scope of license renewal, but not requiring aging management, will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.3.2 Reactor Coolant System - Primary Coolant System - Summary of Aging Management Evaluation - (PNP LRA Table 3.1.2-1)

The project team reviewed PNP LRA Table 3.1.2-1, which summarizes the results of AMR evaluations for the primary coolant system component groups.

In PNP LRA Table 3.1.2-1, the applicant proposes to manage loss of material from low-alloy steel bolting and fasteners exposed to a plant indoor air environment using PNP AMP B2.1.3, "Bolting Integrity Program."

The Bolting Integrity Program was reviewed by NRR DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Bolting Integrity Program, the project team finds that management of loss of material from low-alloy steel bolting and fasteners exposed to a plant indoor air environment in the primary coolant system is acceptable.

In PNP LRA Table 3.1.2-1, the applicant proposes to manage loss of material from the epoxy-coated, carbon-steel pressurizer quench tank exposed to treated water using the One-Time Inspection Program. The project team evaluation of this AMR is documented in Section 3.1.1.5 of this audit and review report and is applicable here.

3.1.3.3 Reactor Coolant System - Reactor Vessel - Summary of Aging Management Evaluation - (PNP LRA Table 3.1.2-2)

The project team reviewed PNP LRA Table 3.1.2-2, which summarizes the results of AMR evaluations for the reactor vessel component groups.

In PNP LRA Table 3.1.2-2, the applicant proposes to manage loss of nickel-based alloy due to fretting of the reactor vessel core stabilizer lugs in a treated water environment using PNP AMP B2.1.2, “ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program.”

The project team reviewed the ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program and its evaluation is documented in Section 2.2 of this audit and review report. ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program facilitates inspections to identify and correct degradation in Class 1, 2, and 3 piping, components, their supports and integral attachments. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of nickel-based alloy material exposed to an external treated water environment are effectively managed using the ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program. On this basis, the project team finds that management of loss of nickel-based alloy due to fretting of the reactor vessel core stabilizer lugs is acceptable.

3.1.3.4 Reactor Coolant System - Reactor Vessel Internals - Summary of Aging Management Evaluation - (PNP LRA Table 3.1.2-3)

The project team reviewed PNP LRA Table 3.1.2-3, which summarizes the results of AMR evaluations for the reactor vessel internals component groups.

In PNP LRA Table 3.1.2-3, the applicant proposes to manage reduction in fracture toughness of the stainless steel instrument sleeve of the upper guide structure using PNP AMP B2.1.17, "Reactor Vessel Internals Inspection Program."

The GALL Report recommends the use of programs consistent with GALL AMP XI.M.16, "PWR Vessel Internals," and XI.M2, "Water Chemistry," to manage reactor vessel internals in the fuel zone region.

In a letter dated August 27, 2005, the applicant states that the Water Chemistry Program will also be used to manage aging of the instrument sleeve.

The project team finds that aging management of this component type is consistent with the GALL Report and therefore acceptable.

3.1.3.5 Reactor Coolant System - Replacement Steam Generators - Summary of Aging Management Evaluation - (PNP LRA Table 3.1.2-4)

The project team reviewed PNP LRA Table 3.1.2-4, which summarizes the results of AMR evaluations for the replacement steam generators component groups.

In PNP LRA Table 3.1.2-4, the applicant proposes to manage loss of material from the low-alloy steel tube bundle wrapper exposed to treated water using only PNP AMP B2.1.21, “Water Chemistry Program.”

In a letter dated August 27, 2005, the applicant states that the effectiveness of the Water Chemistry Program will be verified using PNP AMP B2.1.18, “Steam Generator Tube Integrity Program.”

The project team reviewed the Water Chemistry Program and the Steam Generator Tube Integrity Program. The project team’s evaluations are documented in Sections 2.17 and 2.15 of this audit and review report, respectively. The Water Chemistry Program is credited for managing aging effects such as loss of material due to general, pitting and crevice corrosion; cracking due to SCC; and steam generator tube degradation caused by denting, intergranular attack (IGA) and outer diameter stress corrosion cracking (ODSCC) by controlling the environment to which internal surfaces of systems and components are exposed. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect loss of material from the steel tube bundle wrapper exposed to treated water is effectively managed using the Water Chemistry Program and the Steam Generator Tube Integrity Program. On this basis, the project team finds that management of loss of material from the low-alloy steel tube bundle wrapper exposed to treated water in the replacement steam generator system is acceptable.

Conclusion

On the basis of its review, the project team finds 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 finds 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 PNP LRA Section 3.2 - Aging Management Review of Engineered Safety Features

In PNP LRA Section 3.2, the applicant provided the results of its AMRs for the engineered safety features.

In PNP LRA Table 3.2.2-1, the applicant provided a summary of the AMR results for component types associated with the engineering safeguards system. The summary information for each component type included intended function; material; environment; aging effect requiring management; AMPs; the GALL Report Volume 2 item; cross reference to PNP LRA Table 3.2.1 (Table 1); and generic and plant-specific notes related to consistency with the GALL Report.

By letter dated May 5, 2005 (ML0513202350), the applicant provided additions to PNP LRA Table 3.2.2-1, which were included in the review of PNP AMRs. During the audit and review, numerous questions were developed by the project team that were prompted by the manner in which component types are grouped in the PNP LRA table rather than the manner in which aging effects are managed. To facilitate further review by the project team, the applicant developed a new PNP LRA Table 3.2.2-1, and it is the review of AMRs on the revised table that is described in this report. By letter dated August 27, 2005, the applicant submitted the revised table. The project team used the revised table to perform its audit and review of the engineered safety features systems.

The project team's review of PNP LRA Section 3.2 identified an area in which additional information was necessary to complete the review of the applicant's AMR review results. The applicant responded to the project team's RAI as discussed below.

RAI-3.2.1-1. The Flow Assisted Corrosion (FAC) Program is not listed as an AMP in PNP LRA Sections 3.2.1 and 3.2.3. Such a program is typically necessary to manage the effects of FAC for license renewal. Please verify whether the intent is to credit this AMP, B2.1.1 1, in these sections.

In its response, dated July 1, 2005, the applicant states that PNP does not credit the FAC AMP described in PNP LRA B2.1.11 in PNP LRA Sections 3.2.2.1 and 3.2.2.2.6 because there are no FAC susceptible material environment combinations in those ESF components. Most ESF components in contact with fluid are stainless steel, which is FAC resistant material. Further, except for some cast austenitic stainless steel valves, the PNP ESF components were evaluated in their normal standby static condition of 120°F.

Based on the above discussion, the project team finds the applicant's response to RAI-3.2.1-1 is acceptable because of the lack of any FAC susceptible material environment combinations in the engineering safeguards system. The project team concern described in RAI-3.2.1-1 is resolved.

For each component type in PNP LRA Table 3.2.1 (revised), the applicant identified those component types that are managed in a manner consistent with the GALL Report, those component types for which the GALL Report recommends further evaluation, and those AMRs that are not addressed in the GALL Report together with the method proposed for their aging management.

The project team conducted its audit and review in accordance with SRP-LR Section 3.2.3 and the PNP audit and review plan. The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report, including LR-AMR-ESF, "Engineered Safeguards Features."

3.2.1 Aging Management Review Results That Are Consistent with the GALL Report

For aging management evaluations that the applicant states are consistent with the GALL Report, the project team conducted its audit and review to determine if the applicant's reference to the GALL Report in the PNP LRA is acceptable.

The project team reviewed its assigned PNP LRA line-items to determine that the applicant (1) provides a brief description of the system, components, materials, and environment; (2) states that the applicable aging effects have been reviewed and are evaluated in the GALL Report; and (3) identifies those aging effects for the engineering safeguards system components that are subject to an AMR.

The following subparagraphs identify differences, when compared to the GALL Report, that were identified by the project team during the audit.

3.2.1.1 Loss of Fracture Toughness Due to Thermal Aging Embrittlement of CASS

In the discussion section of Table 3.2.1, Item 3.2.1-11 of the PNP LRA, the applicant states that PNP AMP B2.1.2, "ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program," (ISI Program) is used to manage reduction in fracture toughness due to thermal aging embrittlement of CASS components in the engineering safeguards system.

The GALL Report recommends the use of a program consistent with GALL AMP XI.M12, "Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)," which states that for pump casings and valve bodies the recommendations of GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, AND IWD," are sufficient to manage this aging effect.

During the audit and review, the project team noted that although the applicant was not using GALL AMP XI.M12, it was applying an AMP recommended by the GALL Report for pump casings and valve bodies.

The project team's evaluation of the applicant's ISI Program is documented in Section 2.2 of this audit and review report. The project team finds management of reduction in fracture toughness of valve bodies due to thermal aging embrittlement using the ISI Program to be consistent with the GALL Report and therefore acceptable.

3.2.1.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

In the discussion section of Table 3.2.1, Item 3.2.1-13 of the PNP LRA, the applicant states that PNP AMP B2.1.6, "Closed-Cycle Cooling Water Program," and PNP LRA B2.1.21, "Water Chemistry Program," are used to manage loss of material due to general, pitting, and crevice corrosion from components served by the closed-cycle cooling system. In Table 3.2.2-1 of the PNP LRA, the applicant uses its Water Chemistry Program to manage loss of material from engineered safety features (ESF) components exposed to treated water other than closed-cycle cooling water. For the cast iron LPSI Pump HX shell, this program is augmented with PNP AMP B2.1.13, "One-Time Inspection Program."

The GALL Report recommends the use of a program consistent with GALL AMP XI.M21, “Closed-Cycle Cooling Water System.”

The project team reviewed the Closed-Cycle Cooling Water Program, Water Chemistry Program, and One-Time Inspection Program and its evaluation is documented in Sections 2.4, 2.17, and 2.11 of this audit and review report, respectively.

The project team finds management of this aging effect using the Closed-Cycle Cooling Water Program to be consistent with the GALL Report and therefore acceptable. On the basis of plant-specific and industry operating experience, the project team finds that the Water Chemistry Program augmented with the One-Time Inspection Program (for carbon steel and aluminum components as well as such stainless steel components as the applicant chooses to manage with this combination of AMPs) is an acceptable method for management of loss of material from ESF components exposed to treated water other than closed-cycle cooling water.

3.2.1.3 Crack Initiation and Growth Due to Stress Corrosion Cracking

In the discussion section of Table 3.2.1, Item 3.2.1-15 of the PNP LRA, the applicant states that PNP AMP B2.1.21, “Water Chemistry Program,” is used to manage crack initiation and growth due to SCC. In PNP LRA Table 3.2.2-1, the applicant supplements this program with PNP AMP B2.1.13, “One-Time Inspection Program,” for the aluminum safety injection and refueling water tank (SIRWT), stainless steel SIRWT HX tubes, piping, fittings, and valves of the engineering safeguards system.

The GALL Report recommends the use of a program consistent with GALL AMP XI.M2, “Water Chemistry.”

The project team finds that the applicant’s Water Chemistry Program augmented with its One-Time Inspection Program (for aluminum components as well as stainless steel components the applicant chooses to manage with this AMP) exceed the recommendation of the GALL Report and therefore form an acceptable method for management of crack initiation and growth in the engineering safeguards system.

In the PNP LRA, the applicant states that the ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program (ISI Program) and Water Chemistry Program are used to manage crack initiation and growth in the CASS valves of the engineering safeguards system.

The project team finds that the combination of the applicant’s Water Chemistry and ISI Programs for CASS valves exceeds the recommendation of the GALL Report and together form an acceptable method for management of crack initiation and growth.

3.2.1.4 Loss of Preload Due to Stress Relaxation

In the discussion section of Table 3.2.1, Item 3.2.1-18 of the PNP LRA, the applicant states that PNP AMP B2.1.3, “Bolting Integrity Program,” is used to manage loss of material due to general corrosion; loss of preload due to stress relaxation, and crack initiation and growth due to cyclic loading and/or SCC for closure bolting in high pressure or high temperature systems.

The GALL Report recommends the use of a program consistent with GALL AMP XI.M18, “Bolting Integrity,” to manage loss of material due to general corrosion and crack initiation and growth due to cyclic loading and/or SCC. The application of the Bolting Integrity Program to loss of preload is not mentioned in the GALL Report Table 2, “Summary of Aging Management Programs for the Engineered Safety Features Evaluated in Chapter V of the GALL Report.”

However, in Table 3.2.2-1 of the PNP LRA, the applicant applies the Bolting Integrity Program to the management of all these aging effects for all closure bolting in the engineering safeguards system.

Predicated on NRC DE staff determination that PNP AMP B2.1.3, “Bolting Integrity Program,” is consistent with the GALL Report, the project team finds that loss of material, loss of preload, and crack initiation and growth 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

For all other items that were identified as consistent with the GALL Report and for which no further evaluation was recommended, 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 finds that these AMR results are consistent with the AMRs in the GALL Report. Therefore the project team finds 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 Aging Management Review Results for Which Further Evaluation Is Recommended by the GALL Report

For some line-items assigned to the project team in PNP LRA Table 3.2.2-1, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in PNP LRA Section 3.2.2.2 against the criteria provided in SRP-LR Section 3.2.3.2. The project team’s assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 line-item in Section 3.2 citing the item in Table 1.

3.2.2.1 Cumulative Fatigue Damage (PNP LRA Section 3.2.2.2.1)

PNP LRA Section 3.2.2.2.1 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 TLAA is reviewed by the NRR DE staff. The evaluation of this TLAA will be addressed separately in Section 4 of the SER related to the PNP LRA.

3.2.2.2 Loss of Material Due to General Corrosion (PNP LRA Section 3.2.2.2.2)

3.2.2.2.1 Loss of Material Due to General Corrosion (BWR Only) (PNP LRA Section 3.2.2.2.2.1)

The applicant states that this issue applies to BWRs only.

The GALL Report states that this item applies only to BWRs. For this reason, the project team finds that this item need not be addressed for PNP.

3.2.2.2.2 Loss of Material Due to General Corrosion (PWR Components) (PNP LRA Section 3.2.2.2.2.2)

The project team reviewed PNP LRA Section 3.2.2.2.2.2 against the criteria in SRP-LR Section 3.2.2.2.2.2.

SRP-LR Section 3.2.2.2.2.2 states that loss of material due to general corrosion could occur in the containment spray and spray nozzle components, containment isolation valves and associated piping, and on the external surfaces of carbon steel components. The GALL Report recommends further evaluation on a plant-specific basis to ensure that the aging effect is adequately managed.

In PNP LRA Section 3.2.2.2.2.2, the applicant addresses loss of material of components in containment spray, containment isolation, and emergency core cooling systems due to general corrosion. The PNP LRA states that this aging effect affects carbon steel or cast iron in air and does not apply to stainless steel components in containment spray and emergency core cooling systems. The external surface of carbon steel and cast iron components in the containment spray and emergency core cooling systems are susceptible to general corrosion in an air environment. The System Monitoring Program is credited with managing this aging effect.

The applicant also states that containment isolation components are addressed with their individual systems. Programs credited for aging management of general corrosion are identified in the 3.X.2 table for the system containing the penetration: the aging effect/mechanism for containment isolation in aqueous systems is managed by the Water Chemistry Program supplemented by the One-Time Inspection Program while in gaseous systems, containment sump level instrumentation, and radwaste systems it is managed by the One-Time Inspection Program.

The project team reviewed the applicant’s further evaluation and finds that the applicant has selected appropriate plant-specific AMPs to manage the loss of material due to general corrosion.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.2.2 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3 Local Loss of Material Due to Pitting and Crevice Corrosion (PNP LRA Section 3.2.2.2.3)

3.2.2.3.1 Local Loss of Material Due to Pitting and Crevice Corrosion (BWR Only) (PNP LRA Section 3.2.2.2.3.1)

The applicant states that this issue applies to BWRs only.

The GALL Report states that this item applies only to BWRs. For this reason, project team finds that this item need not be addressed for PNP.

3.2.2.3.2 Local Loss of Material Due to Pitting and Crevice Corrosion (PNP LRA Section 3.2.2.2.3.2)

The project team reviewed PNP LRA Section 3.2.2.2.3.2 against the criteria in SRP-LR Section 3.2.2.2.3.2.

SRP-LR Section 3.2.2.2.3.2 states that local loss of material from pitting and crevice corrosion could occur in the PWR containment spray components, containment isolation valves and associated piping, and the buried portion of the refueling water tank external surface.

In PNP LRA Section 3.2.2.2.3.2, the applicant addresses loss of material of components in containment spray, containment isolation, and emergency core cooling systems due to pitting and crevice corrosion. The PNP LRA states that the PNP containment spray and emergency core cooling system components are stainless steel, susceptible to pitting and crevice corrosion, are managed using the Water Chemistry Program supplemented by the One-Time Inspection Program. The stainless steel containment isolation components are exposed to borated water, susceptible to pitting and crevice corrosion, and managed by the Water Chemistry Program supplemented by the One-Time Inspection Program. In addition, all containment isolation valves and associated piping are currently tested on a set frequency by the Containment Leakage Testing Program. The testing will be continued in the extended period of operation. The safety injection and refueling water (SIRW) tank bottom is located on the auxiliary building roof, not buried. The bottom edge is sealed around its circumference from exposure to the weather. Supply piping enters and exits the bottom of the tank through the roof of the auxiliary building. This arrangement exposes the bottom surface of the tank to a plant indoor air environment. Loss of material due to crevice and pitting is not a potential aging effect/mechanism for aluminum in air.

The project team reviewed the applicant's further evaluation and concluded that it is consistent with the SRP-LR.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.3.2 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.4 Local Loss of Material Due to MIC (PNP LRA Section 3.2.2.2.4)

The project team reviewed PNP LRA Section 3.2.2.2.4 against the criteria in SRP-LR Section 3.2.2.2.4.

SRP-LR Section 3.2.2.2.4 states that local loss of material due to MIC could occur in containment isolation valves and associated piping in systems that are not addressed in other chapters of the GALL Report. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed. Acceptance criteria are described in Branch Technical Position RSLB-1 (Appendix A.1 of the SRP-LR).

In PNP LRA Section 3.2.2.2.4, the applicant addresses loss of material of containment isolation valves and associated piping due to MIC. The PNP LRA states that loss of material due to MIC is considered a potential aging effect/mechanism that requires management, even though the component has no potential source of MIC contamination in treated water. The treated water environment is effectively controlled by the existing Water Chemistry Program.

The applicant states, in the PNP LRA, that containment isolation valve bodies and connecting piping are addressed with their individual systems. Programs credited for aging management are identified in the 3.X.2 table for the system containing the penetration. All containment isolation valves and associated piping are currently tested on a set frequency by the Containment Leakage Testing Program. The testing will be continued in the extended period of operation.

The applicant also states, in the PNP LRA, that the Water Chemistry Program is credited for managing this aging effect/mechanism on containment isolation valves and associated piping in aqueous systems. This is supplemented by the One-Time Inspection Program to determine if the aging effect/mechanism exists, and, if it exists, how rapidly it is progressing.

In addition, the applicant states, in the PNP LRA, that the high temperature (> 210°F) of the main steam, main feedwater and steam generator blowdown containment isolation components preclude MIC.

Furthermore, the applicant states, in the PNP LRA, that the One-Time Inspection Program is credited for managing this aging effect/mechanism in gaseous systems, the containment sump level instrumentation, and radwaste systems containment isolation components.

The project team reviewed the applicant's further evaluation and finds that the applicant has selected appropriate plant-specific AMPs to manage the loss of material due to MIC.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.4 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.5 Changes in Properties Due to Elastomer Degradation Applicable to BWR Only (PNP LRA Section 3.2.2.2.5)

The applicant states that this issue applies to BWRs only.

The GALL Report states that this item applies only to BWRs. For this reason, project team finds that this item need not be addressed for PNP.

3.2.2.6 Local Loss of Material Due to Erosion (PNP LRA Section 3.2.2.2.6)

The project team reviewed PNP 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 local loss of material due to erosion could occur in the high pressure safety injection pump miniflow orifice. This aging mechanism and effect will apply only to pumps that are normally used as charging pumps in the chemical and volume control systems. The GALL Report recommends further evaluation 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 PNP LRA Section 3.2.2.2.6, the applicant addresses loss of material of high pressure safety injection (charging) pump miniflow orifice due to erosion. The PNP LRA states that the high pressure safety injection pumps are not used for normal charging at PNP. Loss of material due to erosion of miniflow orifices is not applicable to PNP.

On the basis that the high pressure safety injection pump miniflow orifice is subjected to flow only infrequently, the project team finds that loss of material due to erosion of the miniflow orifice need not be managed at PNP.

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 these issues. For these items, the project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.3 Aging Management Review Results That Are Not Consistent with the GALL Report or Not Addressed in the GALL Report

In PNP LRA Table 3.2.2-1, 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.

3.2.3.1 Engineered Safety Features System AMR Line Items with No Aging Effect (PNP LRA Table 3.2.2-1)

In PNP LRA Table 3.2.2-1, the applicant identified AMR results line items where no aging effects were identified during aging management review. Specifically, the applicant states that no aging effects were identified for stainless steel exposed to air.

On the basis of its review of current industry research and operating experience, the project team finds that stainless steel exhibits no aging effect that will be of concern during the period of extended operation. Therefore the project team concludes that there are no aging effects requiring management for stainless steel components of the engineering safeguards system exposed to air.

During the audit and review, the project team reviewed the AMR basis documents for ESF systems. Specifically, the project team audited other components having a material and environment combination for which no aging management program is recommended by the GALL Report. The project team found that every aging effect requiring management is reported in PNP LRA Table 3.2.2-1, as amended by letter dated May 5, 2005 and resubmitted by letter dated August 27, 2005. Furthermore, the project team finds that the intended functions of components within the scope of license renewal, but not requiring aging management, will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.3.2 Engineered Safety Features - Engineering Safeguards System - Summary of Aging Management Evaluation - (PNP LRA Table 3.2.2-1)

The project team reviewed PNP LRA Table 3.2.2-1, which summarizes the results of AMR evaluations for the engineering safeguards system component groups.

In PNP LRA Table 3.2.2-1, the applicant proposes to manage heat transfer degradation of stainless steel heat exchanger tubes and cooling coils of the engineering safeguards system exposed to treated water using PNP AMP B2.1.6, “Closed-Cycle Cooling Water Program,” or a combination of B2.1.21, “Water Chemistry Program,” and B2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant’s Closed-Cycle Cooling Water, Water Chemistry, and One-Time Inspection Programs and its evaluation is documented in Sections 2.4, 2.17, and 2.11 of this audit and review report, respectively. The Closed Cycle Cooling Water Program manages aging effects in closed cycle cooling water systems and includes (a) maintenance of system corrosion inhibitor concentrations to minimize degradation, and (b) periodic or one-time testing and inspections to assess aging. The Water Chemistry Program is an existing program that minimizes aging effects by controlling the chemical species that cause or allow them. The program provides assurance that an elevated level of contaminants and, where applicable, oxygen does not exist in the systems and components covered by the program, maintaining each component’s ability to perform the intended functions. The One-Time Inspection Program verifies that the Water Chemistry Program is managing the effects of aging of selected components. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of heat transfer degradation of stainless steel material exposed to treated water environments is effectively managed using the Closed Cycle Cooling Water Program or a combination of the Water Chemistry Program and the One-Time

Inspection Program. On this basis, the project team finds that management of heat transfer degradation in the engineering safeguards system is acceptable.

In PNP LRA Table 3.2.2-1, the applicant proposes to manage cracking of stainless steel PCP seal cooler coils exposed to treated water using PNP AMP B2.1.21, "Water Chemistry Program."

The project team reviewed the Water Chemistry Program and its evaluation is documented in Section 2.17 of this audit and review report. The Water Chemistry Program manages aging effects such as cracking due to SCC by controlling the environment to which internal surfaces of systems and components are exposed. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of cracking of stainless steel PCP seal cooler coils exposed to treated water is effectively managed using the Water Chemistry Program.

In PNP LRA Table 3.2.2-1, the applicant proposes to manage cracking of stainless steel LPSI pump coils and containment spray pump coils exposed to treated water using PNP AMP B2.1.6, "Closed-Cycle Cooling Water Program."

The project team reviewed the Closed-Cycle Cooling Water Program and its evaluation is documented in Section 2.4 of this audit and review report. The Closed Cycle Cooling Water Program manages aging effects in closed cycle cooling water systems and includes (a) maintenance of system corrosion inhibitor concentrations to minimize degradation, and (b) periodic or one-time testing and inspections to assess aging. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of cracking of stainless steel LPSI pump coils and containment spray pump coils exposed to treated water is effectively managed using the Closed-Cycle Cooling Water Program. On this basis, the project team finds that management of crack initiation and growth in the engineering safeguards system is acceptable.

Conclusion

On the basis of its review, the project team finds 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 finds 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 PNP LRA Section 3.3 - Aging Management of Auxiliary Systems

In PNP LRA Section 3.3, the applicant provided the results of its AMRs for the auxiliary systems.

In PNP LRA Tables 3.3.2-1 through 3.3.2-17, the applicant provided a summary of the AMR results for component types associated with (1) the chemical addition system; (2) chemical volume and control system; (3) circulating water system; (4) component cooling water system; (5) compressed air system; (6) containment air recirculation and cooling system; (7) domestic water system; (8) emergency power system; (9) fire protection system; (10) fuel oil system;

(11) heating, ventilation, and air conditioning system; (12) miscellaneous gas system; (13) radwaste system; (14) service water system; (15) shield cooling system; (16) spent fuel pool cooling system; and (17) the waste gas system. The summary information for each component type included intended function; material; environment; aging effect requiring management; AMPs; the GALL Report Volume 2 item; cross reference to PNP LRA Table 3.3.1 (Table 1); and generic and plant-specific notes related to consistency with the GALL Report.

For each component type in PNP LRA Table 3.3.1, the applicant identified those component types that are managed in a manner consistent with the GALL Report, component types for which the GALL Report recommends further evaluation, and those AMRs that are not addressed in the GALL Report together with the method proposed for their aging management.

The project team conducted its audit and review in accordance with SRP-LR Section 3.3.3 and the PNP audit and review plan. The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report, including LR-TR-008-MEAR, "Material Aging Effects Report, Palisades Nuclear Power Plant."

3.3.1 Aging Management Review Results That Are Consistent with the GALL Report

For aging management evaluations that the applicant states are consistent with the GALL Report, the project team conducted its audit and review to determine if the applicant's reference to the GALL Report in the PNP LRA is acceptable.

The project team reviewed its assigned PNP LRA line-items to determine that the applicant (1) provides a brief description of the system, components, materials, and environment; (2) states that the applicable aging effects have been reviewed and are evaluated in the GALL Report; and (3) identifies those aging effects for the chemical addition system; chemical volume and control system; circulating water system; component cooling water system; compressed air system; containment air recirculation and cooling system; domestic water system; emergency power system; fire protection system; fuel oil system; heating, ventilation, and air conditioning system; miscellaneous gas system; radwaste system; service water system; shield cooling system; spent fuel pool cooling system; and the waste gas system components that are subject to an AMR.

The following subparagraphs identify differences, when compared to the GALL Report, that were identified by the project team during the audit and review.

3.3.1.1 Cumulative Fatigue Damage

In Table 3.3.1, Item 3.3.1-03 of the PNP LRA, the applicant states that cumulative fatigue damage is managed using a TLAA.

During the audit and review, the project team asked the applicant to clarify the assignment of this Table 1 item to the management of loss of material of carbon steel heat exchangers exposed to air in PNP LRA Table 3.3.2-11. In a letter dated August 27, 2005, the applicant states that the Table 1 item should be changed from 3.3.1-03 to 3.3.1-05. The project team finds this consistent with the GALL Report and therefore acceptable.

3.3.1.2 Crack Initiation and Growth Due to Cracking or SCC

In Table 3.3.1, Item 3.3.1-04 of the PNP LRA, the applicant states that for high pressure pumps in the chemical volume and control system (CVCS), crack initiation and growth due to SCC or cracking is managed by a plant-specific AMP. During the audit and review, the project team noted that the applicant has applied Table 3.3.1, Item 3.3.1-04 in PNP LRA Table 3.3.2-1 (Page 3-121) for cracking of stainless steel valves and instrument assemblies in treated water. In a letter dated August 27, 2005, the applicant states that SCC/IGA is an AERM for the components of the CVCS that are constructed with stainless steel in an environment of treated water in containment where the temperatures of the CVCS are >140°F. Also, SCC/IGA is an AERM for the heat traced piping of the CVCS located in the auxiliary building with temperatures greater than the threshold of 140°F to sustain SCC/IGA. Not all CVCS components have temperatures greater than 140°F. Stress corrosion cracking/intergranular attack, including crack initiation and growth, is managed where applicable using its ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection, Closed Cycle Cooling Water, One-Time Inspection and/or the Water Chemistry Programs. The applicant also states that Note 303 which reads “cracking is applicable for applications greater than 140°F” is added to Page 3-198. Furthermore, this note is added to PNP LRA Table 3.3.2-1, on Pages 3-118 through 3-121, to every line item that has an existing note associated with the AERM, cracking. The project team reviewed the applicant’s response and finds it acceptable because it is consistent with the GALL Report.

3.3.1.3 Loss of Material Due to General Corrosion, Pitting, Crevice Corrosion, and MIC

In the discussion section of Table 3.3.1, Item 3.3.1-15 of the PNP LRA, the applicant credits the Closed Cycle Cooling Water Program, One-Time Inspection Program, and Water Chemistry Program for managing loss of material of the components in or serviced by closed-cycle cooling water systems. PNP LRA Table 3.3.2-3 identifies Table 3.3.1, Item 3.3.1-15 as the corresponding Table 1 item and for the copper alloy heat exchanger in the treated water environment. PNP LRA Table 3.3.2-3 credits the Closed Cycle Cooling Water Program for managing the loss of material and the One-Time Inspection Program for managing selective leaching of the copper alloys in heat exchangers in treated water and states that the combinations of these material, environment, aging effects, and programs are consistent with GALL Report Items VII.C2.3-a and VII.C2.4-a, respectively. However, for GALL Report Items VII.C2.3-a and VII.C2.4-a, the material is carbon steel and cast iron. During the audit and review, the applicant was asked to provide clarification.

In a letter dated August 27, 2005, the applicant states that the copper alloy heat exchanger components that are being managed by the Closed Cooling Water Program and reads GALL Report Item VII.C2.3-a with a Table 1 item of 3.3.1-15 and notes of 301 and C is revised to read GALL Report Item VII.C1.3-a with a Table 1 item of 3.3.1-17 and notes of 323 and C. In addition, the copper alloy heat exchanger components that are being managed by the One-Time Inspection Program and reads GALL Report Item VII.C2.4-a with a Table 1 item of 3.3.1-15 and notes of 323 and C is revised to read GALL Report Item VII.C1.3-a with a Table 1 item of 3.3.1-29 and notes of 301 and E. The project team reviewed the applicant’s response and finds it acceptable because it is consistent with the GALL Report.

3.3.1.4 Loss of Material Due to General Corrosion, Pitting, Crevice Corrosion, MIC and Biofouling; Buildup of Deposit Due to Biofouling

In the discussion column of Table 3.3.1, Item 3.3.1-17 of the PNP LRA, the applicant credits the Closed Cycle Cooling Water Program, One-Time Inspection Program, and Open Cycle Cooling Water Program for managing loss of material of the components in or serviced by open-cycle cooling water systems. PNP LRA Table 3.3.2-12 (Page 3-185) shows that the Open Cycle Cooling Water Program manages loss of material for cast iron and copper alloys in raw water (internal) and references GALL Report Item VII.C1.2-a which describes selective leaching as a mechanism. Also, PNP LRA Table 3.3.2-16 (Page 3-195) shows that the One-Time Inspection Program manages loss of material for copper alloy in raw water (internal) and references GALL Report Item VII.C1.1-a which describes selective leaching as a mechanism. During the audit and review, the applicant was asked to clarify how the Open Cycle Cooling Water Program manages loss of material due selective leaching for cast iron and copper alloys in raw water.

In a letter dated August 27, 2005, the applicant states that in PNP LRA Table 3.3.2-12 (Page 3-185), valves and dampers, fluid pressure boundary, cast iron, raw water, loss of material, One-Time Inspection Program, PNP LRA Table 3.3.1, Item 3.3.1-17 is changed to read 3.3.1-29. In addition, PNP LRA plant-specific Note 304 is added to this line item. Furthermore, the applicant states that Note 304 (Page 3-198) is changed to read, “This component contains less than 15% zinc; therefore, selective leaching is not a potential aging mechanism.” This response is acceptable because it is consistent with the GALL Report. In regard to copper alloy valves and dampers exposed to raw water, the applicant states in the above letter that the remainder of the copper alloy components at PNP contain less than 15% zinc and, therefore, are not subject to selective leaching. The project team reviewed the applicant’s response and finds this acceptable because it is consistent with the GALL Report.

3.3.1.5 Loss of Material Due to General, Pitting, Crevice Corrosion, and MIC

During the audit and review, the project team noted that PNP LRA Table 3.3.2-8 refers to PNP LRA Table 3.3.1, Item 3.3.1-18, for carbon steel pipes and fittings and references GALL Report Item VII.H1.1-b. The environments identified in GALL Report Item VII.H1.1-b are soil and groundwater. However, the PNP LRA indicates that the environments are plant indoor air and raw water. The project team asked the applicant to clarify this difference. In a letter dated August 27, 2005, the applicant states that the diesel fuel oil components in plant indoor air that are being managed by its System Monitoring Program and reads GALL Report Item VII.H1,1-b with a Table 1 item of 3.3.1-18 and a note of A should read, GALL Report Item VII.I.1-b with a Table 1 item of 3.3.1-5 and a note of A. At PNP, components that have an environment of soil and/or ground water are included in the definition of raw water. The raw water is rough filtered to remove large particles. Biocides may be added to control microorganisms or macro-organisms. Another designation of raw water is water that leaks from any system. Damp soil (moist soil/earth) containing ground water is, also, included in this environment. This grouping includes structural carbon or low-alloy steel in raw water or in non-borated treated water. Therefore, buried components were evaluated as being exposed to a raw water environment. With this clarification, the management of carbon steel pipes and fittings in soil as well as diesel fuel oil components in plant indoor air is consistent with the GALL Report and therefore acceptable to the project team.

3.3.1.6 Loss of Material Due to General Corrosion, Pitting, and Crevice Corrosion

In the discussion column of Table 3.3.1, Item 3.3.1-19 of the PNP LRA, the applicant credits the One-Time Inspection Program for managing loss of material of the components in the compressed air system.

PNP LRA Table 3.3.2-4 (Pages 3-130, 131, 133, 135), refers to Table 3.3.1, Item 3.3.1-19 and references GALL Report Items VII.D1.1-a, 2-a, 3-a, 5-a, and 6-a. Also, PNP LRA Tables 3.3.2-4 (Pages 3-131, 132, 134, 135) and 3.3.2-10 (Page 3-171), refers to Table 1 Item 3.3.1-19 and references GALL Report Item VII.D1.5-a. The PNP LRA indicates that the AMP is the One-Time Inspection Program. The AMP listed in the GALL Report referenced GALL AMP XI.M24, "Compressed Air Monitoring." GALL AMP XI.M24 incorporates air quality measuring and maintenance.

During the audit and review, the applicant was asked to explain how the One-Time Inspection Program is used in lieu of GALL AMP XI.M24 for managing loss of material of carbon steel, cast iron and galvanized components in air. In a letter dated August 27, 2005, the applicant states that it will develop a Compressed Air Monitoring Program. The PNP LRA will be updated to describe this new program. The components in the compressed air system that credit the One-Time Inspection Program to manage aging effects in an internal environment of air will be changed to reference its new Compressed Air Monitoring Program. The project team reviewed the applicant's response and finds it acceptable because it is consistent with the GALL Report. Predicated on the basis that the PNP Compressed Air Monitoring Program will be consistent with GALL AMP XI.M24, "Compressed Air Monitoring," the project team finds this to be acceptable. **[This is Open Item OI-3.3.1-1]**.

PNP LRA Table 3.3.2-4 (Page 3-131), refers to Table 3.3.1, Item 3.3.1-19 and references GALL Report Item VII.D.5-a. The PNP LRA indicates that the AMP is the Boric Acid Corrosion Program which is not consistent with the GALL Report citations. During the audit and review, the applicant was asked to explain how the GALL Report Item and Table 1 item applies to the indicated material, environment, aging effect and program (MEAP). In a letter dated August 27, 2005, the applicant states that for the Boric Acid Corrosion Program, GALL Report Item VII.D.5-a is revised to GALL Report Item VII.I.1-a and reference PNP LRA Table 3.3.1, Item 3.3.1-14. The project team reviewed the applicant's response and finds it acceptable because it is consistent with the GALL Report.

PNP LRA Table 3.3.2-10 (Page 3-171), refers to Table 3.3.1, Item 3.3.1-19 and references GALL Report Items VII.D1.1-a, 2-a, 3-a, 5-a, and 6-a. The PNP LRA indicates that the Bolting Integrity Program manages loss of material of carbon steel miscellaneous components in containment/plant indoor air (external). During the audit and review, the applicant was asked to explain how the GALL Report item and Table 1 item apply the indicated material, environment, aging effect and program (MEAP).

In a letter dated August 27, 2005, the applicant states that on Page 3-171 of the PNP LRA, the component type, misc. mechanical, will be changed to fasteners since there are no aging effects requiring management (AERM) for the copper alloy manifold or the stainless steel monitor. GALL Report Items VII.D.1-a, .2-a, .3-a, .5-a, and .6-a will be corrected to a single GALL Report Item VII.I.1-b managed by the System Monitoring Program with reference to Table

3.3.1, Item 3.3.1-05 and a Note A. This is consistent with the GALL Report and therefore acceptable to the project team.

For loss of material, the Bolting Integrity Program will be changed to the System Monitoring Program. The project team reviewed the applicant's response and finds it acceptable because it is consistent with the GALL Report. Also on page 3-171, loss of preload managed by the Bolting Integrity Program will not have a GALL Report Volume 2 or LRA Table 1 reference and will have codes of 324 and H. On Page 3-172, the continuation from Page 3-171 will be fasteners with codes of 324 and H. The project team reviewed the applicant's response and found it acceptable because loss of preload is not an aging effect requiring management for component types of miscellaneous mechanical and fasteners in auxiliary systems. However, the applicant has conservatively decided to manage this aging effect with its Bolting Integrity Program.

3.3.1.7 <u>Loss of Material Due to General Corrosion, Pitting, and Crevice Corrosion</u>

In the discussion column of Table 3.3.1, Item 3.3.1-23 of the PNP LRA, the applicant credits Diesel Fuel Monitoring and Storage, One-Time Inspection, and System Monitoring Programs for managing loss of material due to general, pitting, and crevice corrosion for aboveground carbon steel tanks of the diesel fuel oil system.

During the audit and review, the project team noted that the applicant is using Table 3.3.1, Item 3.3.1-23 to manage loss of material from the external surfaces of cast iron pumps in air using the System Monitoring Program. The project team asked the applicant to clarify the assignment of Table 3.3.1, Item 3.3.1-23 to cast iron pumps.

In a letter dated August 27, 2005, the applicant states that the cast iron diesel fuel oil pumps in plant indoor air are to be managed using the System Monitoring Program and revised the LRA to read GALL Report Volume 2 Item VII.I.1-b and Table 3.3.1 Item 3.3.1-5. This is consistent with the GALL Report and therefore acceptable to the project team.

3.3.1.8 <u>Loss of Material Due to General Corrosion; Crack Initiation and Growth Due to Cyclic Loading and SCC</u>

In the discussion section of Table 3.3.1, Item 3.3.1-24 of the PNP LRA, the applicant refers to the Boric Acid Corrosion Monitoring Program, One-Time Inspection Program, and System Monitoring Program for managing loss of material for the closure bolting. The GALL Report recommends the Bolting Integrity Program for managing this aging effect. PNP LRA Tables 3.3.2-1, 3.3.2-2, 3.3.2-3, 3.3.2-5, 3.3.2-7, 3.3.2-8, 3.3.2-9, 3.3.2-11, 3.3.2-14, and 3.3.2-15 credit the Bolting Integrity Program for managing loss of preload and loss of material for carbon steel and low-alloy steel fasteners in air and reference GALL Report Item VII.I.2-a and Table 3.3.1, Item 3.3.1-24. However, GALL Report Item VII.I.2-a addresses the loss of material of carbon and low-alloy steel only. During the audit and review, the applicant was asked to explain the applicability of this GALL Report item to loss of preload for these components.

In a letter dated August 27, 2005, the applicant states that the tables listed that are being managed by the Bolting Integrity Program and read GALL Report Item VII.I.2-a, reference Note 324. Note 324 states that loss of preload is included here in response to recent NRC RAIs on non-primary system, high temperature bolting that may experience loss of preload. The PNP Bolting Integrity Program manages potential bolting AERMs and event driven degradation. GALL Report reconciliation is based on loss of material. Therefore, loss of preload was conservatively evaluated for non-safety-related components. The project team reviewed the applicant's response and finds it exceeds the recommendation of the GALL Report and is therefore acceptable.

For cast iron steam traps exposed to plant indoor air, PNP LRA Table 3.3.2-6 (Page 3-150) references GALL Report Item VII.I.2-b. GALL Report Item VII.I.2-b is for carbon and low-alloy steel in moist air to manage crack initiation and growth through the Bolting Integrity Program. However, in the PNP LRA it is used for cast iron traps in air and manages loss of material using the System Monitoring Program. During the audit and review, the applicant was asked to explain the consistency of the PNP LRA to this GALL Report item.

In a letter dated August 27, 2005, the applicant states that the emergency power system traps in plant indoor air that are being managed by the System Monitoring Program and reads GALL Report Item VII.I.2-b with Table 1 Item 3.3.1-24 and Notes 399 and A, should read, GALL Report Item VII.I.1-b with Table 1 Item 3.3.1-5 and Notes 399 and A. The project team reviewed the applicant's response and finds it acceptable because it is consistent with the GALL Report.

3.3.1.9 Loss of Material Due to Selective Leaching

In the discussion section of Table 3.3.1, Item 3.3.1-15 of the PNP LRA, the applicant credits the Closed Cycle Cooling Water Program, One-Time Inspection Program, and Water Chemistry Program for managing loss of material for the components in or serviced by closed-cycle cooling water systems. PNP LRA Tables 3.3.2-11, 3.3.2-12, and 3.3.2-15 refer to Table 1 Item 3.3.1-29 (selective leaching). The affected materials are carbon steel for which selective leaching does not apply. The project team asked the applicant to explain how the Table 1 item is used for carbon steel.

In a letter dated August 27, 2005, the applicant states that for PNP LRA Table 3.3.2-11, 3.3.2-12, and 3.3.2-15, GALL Report Item VII.C3.1-a, Table 1 Item 3.3.1-29 should read, 3.3.1-15. The project team reviewed the applicant's response and finds it acceptable because it is consistent with the GALL Report.

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 finds that all other AMR results that the applicant identified as consistent with the GALL Report are consistent with the AMRs in the GALL Report. Therefore the project team finds that, **predicated on satisfactory resolution of OI-3.3.1-1,** 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 Aging Management Review Results for Which Further Evaluation Is Recommended by the GALL Report

For some line-items assigned to the project team in PNP LRA Tables 3.3.2-1 through 3.3.2-17, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in PNP LRA Section 3.3.2.2 against the criteria provided in 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 line-item in Section 3.3 citing the item in Table 1.

3.3.2.1 Loss of Material Due to General, Pitting, and Crevice Corrosion (PNP LRA Section 3.3.2.2.1)

The project team reviewed PNP LRA Section 3.3.2.2.1 against the criteria in SRP-LR Section 3.3.2.2.1.

SRP-LR Section 3.3.2.2.1.1 states that loss of material due to general, pitting, and crevice corrosion could occur in the channel head and access cover, tubes, and tubesheets of the heat exchanger in the spent fuel pool cooling and cleanup. The Water Chemistry Program relies on monitoring and control of reactor water chemistry based on guidelines contained in EPRI TR-105714 for primary water chemistry and EPRI TR-102134 for secondary water chemistry to manage the effects of loss of material from general, pitting or crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause general, pitting, or crevice corrosion. Therefore, verification of the effectiveness of the Chemistry Control Program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from general, pitting, and crevice corrosion to verify the effectiveness of the Water Chemistry Program. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

SRP-LR Section 3.3.2.2.1.2 states that loss of material due to pitting and crevice corrosion could occur in the filter housing, valve bodies, and nozzles of the ion exchanger in the spent fuel pool cooling and cleanup system. The Water Chemistry Program relies on monitoring and control of reactor water chemistry based on guidelines contained in EPRI TR-105714 for primary water chemistry and EPRI TR-102134 for secondary water chemistry to manage the effects of loss of material from pitting or crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause pitting or crevice corrosion. Therefore, verification of the effectiveness of the Chemistry Control Program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from pitting and crevice corrosion to verify the effectiveness of the Water Chemistry Program. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In PNP LRA Section 3.3.2.2.1, the applicant addresses loss of material of components in the spent fuel pool cooling and cleanup system due to general, pitting and crevice corrosion. The PNP LRA states that the materials of the spent fuel pool cooling components evaluated in the

GALL Report are carbon steel with elastomer linings, which differ from the stainless steel spent fuel pool cooling system components of PNP. The applicant states that this aging effect is not applicable to the PNP spent fuel pool cooling system.

The project team reviewed the PNP LRA Table 3.2.2-14 AMR for the spent fuel pool cooling system and verified that the system did not contain carbon steel components with elastomer linings. On the basis of its review, the project team finds this Table 1 line item is not applicable for components in the spent fuel pool cooling system.

The applicant proposes to manage loss of material of stainless steel pipe, pumps, and spent fuel pool heat exchangers and valves component types exposed to chemically treated borated water using PNP AMP B2.1.21, "Water Chemistry Program," which is consistent with GALL AMP XI.M2, "Water Chemistry. The applicant also uses PNP AMP B2.1.13, "One Time Inspection" program to verify effectiveness of the Water Chemistry Program. The project team reviewed the Water Chemistry Program and the One-Time Inspection Program and their evaluations are documented in Sections 2.17 and 2.11, of this audit and review report, respectively. On the basis of its review, the project team finds that the Water Chemistry and One-Time Inspection Programs are acceptable for managing this aging effect for the stainless steel components in treated water.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.1 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2 <u>Hardening and Cracking or Loss of Strength Due to Elastomer Degradation or Loss of Material Due to Wear (PNP LRA Section 3.3.2.2.2)</u>

The project team reviewed PNP 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 hardening and cracking due to elastomer degradation could occur in elastomer linings of the filter, valve, and ion exchangers in spent fuel pool cooling and cleanup systems. Hardening and loss of strength due to elastomer degradation could occur in the collars and seals of the duct and in the elastomer seals of the filters in the control room area, auxiliary and radwaste area, and primary containment heating and ventilation systems, and in the collars and seals of the duct in the diesel generator building ventilation system. Loss of material due to wear could occur in the collars and seals of the duct in the ventilation systems. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of the SRP-LR).

In PNP LRA Section 3.3.2.2.2, the applicant addresses hardening and cracking of loss of strength due to elastomer degradation or loss of material due to wear. In PNP LRA Section 3.3.2.2.2, the applicant states that the materials of the spent fuel pool cooling components subject to an aging management review have no elastomers. For the ventilation systems, elastomers are evaluated for cracking and changes of material properties due to thermal and radiation exposure. The System Monitoring Program manages degradation of elastomers at the seals and flexible connections. Elastomers are used in other systems. For those systems, management of elastomer degradation is provided by the System Monitoring Program.

The project team reviewed the applicant's further evaluation described above and concluded that it is consistent with the SRP-LR.

The project team finds that, based on the program identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.2 for further evaluation. Predicated on DE acceptance of the System Monitoring Program, the project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3 Cumulative Fatigue Damage (PNP LRA Section 3.3.2.2.3)

PNP LRA Section 3.3.2.2.3 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 TLAA is reviewed by the NRR DE staff. The evaluation of this TLAA will be addressed separately in Section 4 of the SER related to the PNP LRA.

3.3.2.4 Crack Initiation and Growth Due to Cracking or SCC (PNP LRA Section 3.3.2.2.4)

The project team reviewed PNP LRA Section 3.3.2.2.4 against the criteria in SRP-LR Section 3.3.2.2.4.

SRP-LR Section 3.3.2.2.4 states that crack initiation and growth due to SCC could occur due to cracking in the high-pressure pump in the chemical and volume control system. The GALL Report recommends further evaluation to ensure that these aging effects are managed adequately. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of the SRP-LR).

In PNP LRA Section 3.3.2.2.4, the applicant addresses crack initiation and growth of high pressure pumps in chemical and volume control systems due to SCC or cracking. The PNP LRA states that this paragraph of the SPR-LR, which discusses cracking in the high-pressure pump is not applicable to PNP because the pump temperature is < 140°F, which is below the temperature threshold required to support cracking.

The project team reviewed the applicant's further evaluation discussion provided above and finds that cracking in the high-pressure pump in the chemical volume and control system is not applicable to PNP. On this basis, the project team finds that cracking for the high-pressure pumps I n the chemical volume and control system does not require managing.

3.3.2.5 Loss of Material Due to General, Pitting, and Crevice Corrosion, and MIC (PNP LRA Section 3.3.2.2.5)

The project team reviewed PNP LRA Section 3.3.2.2.5 against the criteria in SRP-LR Section 3.3.2.2.5.

SRP-LR Section 3.3.2.2.5 states that loss of material due to general, pitting, and crevice corrosion could occur in the piping and filter housing and supports in the control room area, the auxiliary and radwaste area, the primary containment heating and ventilation systems, in the piping of the diesel generator building ventilation system, in the aboveground piping and fittings, valves, and pumps in the diesel fuel oil system and in the diesel engine starting air, combustion air intake, and combustion air exhaust subsystems in the emergency diesel generator system. Loss of material due to general, pitting, crevice, and MIC could occur in the duct fittings, access doors, and closure bolts, equipment frames and housing of the duct, due to pitting and crevice corrosion could occur in the heating/cooling coils of the air handler heating/cooling, and due to general corrosion could occur on the external surfaces of all carbon steel structures and components, including bolting exposed to operating temperatures less than 212°F in the ventilation systems. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1, of the SPR-LR).

In PNP LRA Section 3.3.2.2.5, the applicant addresses loss of material of components in ventilation systems, diesel fuel oil systems, and emergency diesel generator systems; external surfaces of carbon steel components due to general, pitting, and crevice corrosion, and MIC. The PNP LRA states that this paragraph of the SRP-LR discusses the loss of material from corrosion that could occur on internal and external surfaces of components exposed to plant indoor air and atmosphere and weather. Specifically included are the ventilation systems, diesel fuel oil, emergency diesel starting air, and combustion air intake and exhaust systems, and the external carbon steel surfaces of auxiliary systems.

In the PNP LRA, the applicant states, that for the internal environments of applicable auxiliary systems, PNP AMPs B2.1.14, “Open Cycle Cooling Water Program;” B2.1.9, “Diesel Fuel Monitoring and Storage Program;” B2.1.13, “One-Time Inspection Program” (including tank internal inspection); and B2.1.10, “Fire Protection Program” are credited for managing the aging effect of loss of material.

The applicant also states, in the PNP LRA, that for the external surfaces of all carbon steel components in auxiliary systems, the System Monitoring Program is credited for managing the aging effect of loss of material. The Open Cycle Cooling Water Program and the Fire Protection Program are credited to augment the System Monitoring Program for managing external aging effects in the service water and fire protection systems, respectively. Closure bolting is managed by the Bolting Integrity Program.

During the audit and review, the project team asked the applicant to clarify how the Open Cycle Cooling Water Program manages the external surfaces of carbon steel components in auxiliary systems. In a letter dated September 2, 2005, the applicant states that the Open Cycle Cooling Water Program was erroneously included in Section 3.3.2.2.5. The revised Section 3.3.2.2.5 does not include any reference to this program.

The PNP LRA Table 2s address this Table 1 item where it manages loss of material due to general, pitting, and crevice corrosion, and microbiologically induced corrosion for internal and external surfaces of components exposed to plant indoor air and atmosphere and weather for the ventilation systems, diesel fuel oil, emergency diesel starting air, and combustion air intake and exhaust systems, and the external carbon steel surfaces of auxiliary systems.

The Fire Protection Program manages loss of material of the fuel oil system carbon steel valves and dampers in plant indoor (external) environment. PNP LRA Section B2.1.10, for the detection of aging effects program element, states that PNP credits the One-Time Inspection Program for aging management of RCP oil collection tank, piping and valve bodies for wall thickness and aging related degradation.

The project team reviewed PNP AMP B2.1.13, "One-Time Inspection Program;" PNP AMP B2.1.20, "System Monitoring Program;" PNP AMP B2.1.0, "Fire Protection Program;" and PNP AMP B2.1.3, "Bolting Integrity Program." The project team's evaluations of the One-Time Inspection Program and Fire Protection Program are documented in Sections 2.11 and 2.8 of this audit and review report, respectively. The NRR DE staff evaluations of the Bolting Integrity Program and the System Monitoring Program are documented in Section 3 the SER related to the PNP LRA.

The project team finds that, predicated on DE's acceptance of the Bolting Integrity and System Monitoring Programs, the applicant has met the criteria of SRP-LR Section 3.3.2.2.5 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.6 Loss of Material Due to General, Galvanic, Pitting, and Crevice Corrosion (PNP LRA Section 3.3.2.2.6)

The project team reviewed PNP 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 loss of material due to general, galvanic, pitting, and crevice corrosion could occur in tanks, piping, valve bodies, and tubing in the reactor coolant pump oil collection system in fire protection. The Fire Protection Program relies on a combination of visual and volumetric examinations in accordance with the guidelines of 10 CFR Part 50 Appendix R and Branch Technical Position 9.5-1 to manage loss of material from corrosion. However, corrosion may occur at locations where water from wash downs may accumulate. Therefore, verification of the effectiveness of the program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general, galvanic, pitting, and crevice corrosion to verify the effectiveness of the program. A one-time inspection of the bottom half of the interior surface of the tank of the reactor coolant pump oil collection system is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In PNP LRA Section 3.3.2.2.6, the applicant addresses loss of material of tanks, piping, valve bodies, and tubing in the reactor coolant pump oil collection system in fire protection due to galvanic, general, pitting, and crevice corrosion. The PNP LRA states that the Fire Protection Program has a separate oil collection system for each primary coolant pump (PCP). The GALL Report assumes that the reactor coolant pump oil collection tanks and piping is constructed from carbon steel, copper and stainless steel alloys. However, the PNP oil collection tank, drip pans and oil lift pump enclosures are stainless steel. Annealed copper tubing is used to connect these components and direct the path of any oil leakage from the PCP motor. These materials are located inside containment. They are normally exposed to a containment air internal and external environment. Any oil that is collected will be lubricating oil without any water entrainment. Loss of material due to general and galvanic corrosion is not applicable to this oil collection system. If water condensed from air or spray from some water source were to enter the system then crevice and pitting corrosion could be an aging effect. A one-time inspection of the tank and piping is credited to ensure that loss of material due to crevice and pitting corrosion are not occurring.

The applicant credits PNP AMP B2.1.13, “One-Time Inspection Program” for inspections of carbon steel, cast iron, and copper alloys components in steam and power and auxiliary systems in lube oil (internal and external) environment. The One-Time Inspection Program provides methods for verifying an aging management program is not needed, verifying the effectiveness of an existing program, or determining that degradation is occurring which will require evaluation and corrective action. The project team reviewed the One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report.

The project team finds that, based on the program identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.6 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.7 Loss of Material Due to General, Pitting, Crevice, and MIC and Biofouling (PNP LRA Section 3.3.2.2.7)

The project team reviewed PNP LRA Section 3.3.2.2.7 against the criteria in SRP-LR Section 3.3.2.2.7.

SRP-LR Section 3.3.2.2.7 states that loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling could occur in the internal surface of tanks in the diesel fuel oil system and due to general, pitting, and crevice corrosion and MIC in the tanks of the diesel fuel oil system in the emergency diesel generator system. The existing aging management program relies on the Fuel Oil Chemistry Program for monitoring and control of fuel oil contamination in accordance with the guidelines of ASTM Standards D4057, D1796, D2709 and D2276 to manage loss of material due to corrosion or biofouling. Corrosion or biofouling may occur at locations where contaminants accumulate. Verification of the effectiveness of the Chemistry Control Program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion/biofouling to verify the effectiveness of the program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component’s intended function will be maintained during the period of extended operation.

In PNP LRA Section 3.3.2.2.7, the applicant addresses loss of material of diesel fuel oil tanks in the diesel fuel oil system and the emergency diesel generator system due to general, pitting, and crevice corrosion, MIC, and biofouling. The PNP LRA states that the Diesel Fuel Monitoring and Storage Program manages components in the fuel oil system associated with the emergency diesel generators and diesel fire pumps, including storage tanks, day tanks, piping, valve bodies, and other passive components rely on the Diesel Fuel Monitoring and Storage Program to minimize the potential for degradation and loss of intended function. The program manages the conditions that would cause general, pitting and MIC of the diesel fuel tank internal surfaces.

The applicant also states, in the PNP LRA, that the One-Time Inspection Program provides reasonable assurance that aging effects will be managed such that SSCs within the scope of this program will continue to perform their intended functions consistent with the current licensing bases for the period of extended operation.

Based on a review of the applicant's information in PNP LRA Section 3.3.2.2.7, the project team concludes that the applicant has applied the appropriate aging management program including using its One-Time Inspection Program to assure that the aging effects are being managed.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.7 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.8 Quality Assurance for Aging Management of Non-Safety-Related Components (PNP LRA Section 3.3.2.2.8)

PNP LRA Section 3.3.2.2.8 is reviewed by the NRR DIPM staff and will be addressed separately in Section 3 of the SER related to the PNP LRA.

3.3.2.9 Crack Initiation and Growth Due to SCC and Cyclic Loading (PNP LRA Section 3.3.2.2.9)

The project team reviewed PNP LRA Section 3.3.2.2.9 against the criteria in SRP-LR Section 3.3.2.2.9.

SRP-LR Section 3.3.2.2.9 states that crack initiation and growth due to SCC and cyclic loading could occur in the channel head and access cover, tubesheet, tubes, shell and access cover, and closure bolting of the regenerative heat exchanger and in the channel head and access cover, tubesheet, and tubes of the letdown heat exchanger in the chemical and volume control system. The Water Chemistry Program relies on monitoring and control of water chemistry based on the guidelines of TR-105714 for primary water chemistry in PWRs to manage the effects of crack initiation and growth due to SCC and cyclic loading. Verification of the effectiveness of the Water Chemistry Program should be performed to ensure that crack initiation and growth are not occurring. The GALL Report recommends further evaluation to manage crack initiation and growth from SCC and cyclic loading for these systems to verify the effectiveness of the Water Chemistry Program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that crack initiation and growth are not occurring and that the components' intended function will be maintained during extended operations.

In PNP LRA Section 3.3.2.2.9, the applicant addresses crack initiation and growth of heat exchangers in chemical and volume control systems due to SCC and cyclic loading. The PNP LRA states that the Water Chemistry Program is credited for managing aging effects such as loss-of-material due to general, pitting and crevice corrosion, MIC, cracking due to SCC, and fouling due to corrosion product buildup in stagnant and low flow regions, by controlling the environment to which internal surfaces of systems and components are exposed. The aging effects are minimized by controlling the chemical species that cause the underlying mechanisms that result in these aging effects. The program provides assurance that an elevated level of contaminants and oxygen does not exist in the systems and components covered by the program, thus minimizing the occurrences of aging effects, and maintaining components ability to perform their intended functions. The program is based on the guidelines in EPRI TR-105714, Revision 5 and TR-102134, Revision 5.

The applicant states, in the PNP LRA, that the One-Time Inspection Program is credited by the Water Chemistry Program and its corresponding GALL AMP XI.M2 for managing the effects of aging in stagnant or low-flow areas of components. The Water Chemistry Program may be credited for managing aging effects for components where the water flow is low or stagnant conditions exist. However, water chemistry sampling points may not be indicative of conditions in stagnant or low-flow locations. Therefore, confirmatory inspections are appropriate. Accordingly, to ensure that significant degradation is not occurring and to ensure that the component will continue to perform its intended function during the period of extended operation, a one-time inspection of selected components will be performed.

Based on a review of the applicant's information in PNP LRA Section 3.3.2.2.7, the project team concludes that the applicant has applied the appropriate aging management program including using its One-Time Inspection Program to assure that the aging effects are being managed.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.9 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.10 Reduction of Neutron-Absorbing Capacity and Loss of Material Due to General Corrosion (PNP LRA Section 3.3.2.2.10)

The project team reviewed PNP LRA Section 3.3.2.2.10 against the criteria in SRP-LR Section 3.3.2.2.10.

SRP-LR Section 3.3.2.2.10 states that reduction of neutron-absorbing capacity and loss of material due to general corrosion could occur in the neutron-absorbing sheets of the spent fuel storage rack in the spent fuel storage. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed. Acceptance criteria are described in Branch Technical Position RLSB-1 (Appendix A.1 of the SRP-LR).

In PNP LRA Section 3.3.2.2.10, the applicant states that the PNP spent fuel storage racks contain B_4C (boron carbide) and Boraflex neutron absorbing material. Due to industry concerns on degradation of Boraflex, soluble boron is maintained at 1720 ppm per Technical Specification LCO 3.7.15 to maintain k-effective less than or equal to 0.95. Criticality calculations take credit for the soluble boron in the spent fuel pool water and conclude that Boraflex material does not need to be credited. For the storage racks containing boron carbide, no credit is taken for soluble boron. There is no industry experience that boron carbide sheathed in stainless steel has experienced loss of material due to corrosion. With regards to reduction of neutron absorbing capability due to corrosion, NRC memorandum entitled "Resolution of Spent Fuel Storage Pool Action Plan Issue," dated July 26, 1996, Section 3.3.1 states "…degradation in neutron absorption performance has not been observed in materials other than Boraflex."

The applicant states, in the PNP LRA, that therefore, no plant-specific aging management program is required to manage reduction of neutron-absorbing capacity and loss of material due to general corrosion, as addressed in the GALL Report, Item VIIA2.1-b, in VIIA2, spent fuel storage. The stainless steel sheathing for the boron carbide will be age managed for loss of material due to pitting or crevice corrosion cracking via the Water Chemistry Program, consistent with GALL Report, Item VIIA2.1c. Boraflex, as discussed in GALL Report Item VIIA2.1a, is not within the scope of license renewal since it performs no intended function.

On this basis, the project team finds that, because PNP does not credit Boraflex in the criticality calculation, no plant-specific aging management program is required to manage the reduction of neutron-absorbing capacity.

3.3.2.11 Loss of Material Due to General, Pitting, Crevice, and MIC (PNP LRA Section 3.3.2.2.11)

The project team reviewed PNP 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 loss of material due to general, pitting, and crevice corrosion and MIC could occur in the underground piping and fittings in the open-cycle cooling water system (service water system) and in the diesel fuel oil system. The Buried Piping and Tanks Inspection Program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general, pitting, and crevice corrosion and MIC. The effectiveness of the Buried Piping and Tanks Inspection Program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.

In PNP LRA Section 3.3.2.2.11, the applicant addresses loss of material of buried piping and fittings due to general, pitting, and crevice corrosion and MIC. The PNP LRA states that the Buried Services Corrosion Monitoring Program manages aging effects on the external surfaces of carbon steel, low-alloy steel, and stainless steel components (e.g., tanks, piping) that are buried in soil or sand. This program includes (a) visual inspections of external surfaces of buried components for evidence of coating damage and substrate degradation to manage the effects of aging; and (b) visual inspection of the external surfaces of buried stainless steel components for evidence of crevice corrosion, pitting, and MIC. The periodicity of these inspections for carbon, low-alloy, and stainless steel will be based on opportunities for inspection such as scheduled maintenance work. In response to project team audit questions, the applicant states in a letter dated August 25, 2005 the following:

> Prior to entering the extended period of operation, we will verify that there is at least one opportunistic or focused inspection performed within the last ten years. Visual inspections of a sample of buried carbon, low-alloy, and stainless steel components will be performed within ten years after entering the period of extended operation, unless opportunistic inspections have occurred within this

ten-year period. Prior to the tenth year, NMC will perform an evaluation of available data to determine if sufficient inspections have been performed to assess the condition of the components. If insufficient data exists, focused inspection's will be performed as needed. Any credited inspection should be performed in areas with the highest likelihood of corrosion problems, and in areas with a history of corrosion problems.

The project team reviewed the applicant's Buried Services Corrosion Monitoring Program and its evaluation is documented in Section 2.3 of this audit and review report.

The project team finds that, based on the program identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.11 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion

On the basis of its review, for component groups evaluated in the GALL Report for which the GALL Report recommends further evaluation, the project team determined that the applicant adequately addressed these issues. For these items, the project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.3 Aging Management Review Results That Are Not Consistent with the GALL Report or Not Addressed in the GALL Report

In PNP LRA Tables 3.3.2-1 through 3.3.2-17, 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.

3.3.3.1 Auxiliary Systems AMR Line Items with No Aging Effect (PNP LRA Tables 3.3.2-1 through 3.3.2-17)

In PNP LRA Tables 3.3.2-1 through 3.3.2-17, no item was listed unless an aging effect requiring management had been identified through the aging management review process.

During the audit and review, the project team reviewed the AMR basis documents for auxiliary systems. Specifically, the project team audited components having a material and environment combination for which no aging management program is recommended by the GALL Report. The project team found that every aging effect requiring management is reported in PNP LRA Tables 3.3.2-1 through 3.3.2-17. Furthermore, the project team finds that the intended functions of components within the scope of license renewal, but not requiring aging management, will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.3.2 Auxiliary Systems - Chemical and Volume Control System - Summary of Aging Management Evaluation - (PNP LRA Table 3.3.2-1)

The project team reviewed PNP LRA Table 3.3.2-1, which summarizes the results of AMR evaluations for the chemical and volume control system component groups.

In PNP LRA Table 3.3.2-1, the applicant proposes to manage loss of material of stainless steel boric acid storage tanks exposed to an internal air (borated water potential for exposure) environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds that for stainless steel material exposed to an internal air (borated water potential for exposure) environment, loss of material is not an expected aging effect requiring management. On this basis, the project team finds that management of loss of stainless steel material exposed to (borated water potential for exposure) environment in the chemical and volume control system with the One-Time Inspection Program is acceptable.

In PNP LRA Table 3.3.2-1, the applicant proposes to manage loss of material of brass oil cooler shell exposed to an external plant indoor air environment using PNP AMP B2.1.4, “Boric Acid Corrosion Program.”

The applicant’s Boric Acid Corrosion Program was reviewed by NRR DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Boric Acid Corrosion Program, the project team finds that management of loss of material of brass oil cooler shell exposed to an external air environment in the chemical and volume control system is acceptable.

In PNP LRA Table 3.3.2-1, the applicant proposes to manage loss of material of stainless steel nozzle - CVC spray exposed to an external gas environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant’s One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds that for stainless steel material exposed to an external gas environment, loss of material is not an expected aging effect requiring management. On this basis, the project team finds that management of loss of material of stainless steel nozzle-CVC spray component type exposed to an external gas environment in the chemical and volume control system with the One-Time Inspection Program is acceptable.

In PNP LRA Table 3.3.2-1 (Page 3-118), the applicant proposes to manage loss of material of copper nickel oil cooler tubes exposed to an internal treated water environment using PNP AMP B2.1.6, “Closed Cycle Cooling Water Program.”

The project team reviewed the Closed Cycle Cooling Water Program and its evaluation is documented in Section 2.4 of this audit and review report. The Closed Cycle Cooling Water Program manages aging effects in closed cycle cooling water systems that are not subject to significant sources of contamination, in which water chemistry is controlled and heat is not directly rejected to the ultimate heat sink. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of copper nickel material exposed to an internal treated water environment is effectively managed using the Closed Cycle Cooling Water Program. On this basis, the project team finds that management of loss of material in chemical and volume control system is acceptable.

In PNP LRA Table 3.3.2-1 (Pages 3-118 and 3-120), the applicant proposes to manage loss of material of the brass oil cooler shell and stainless steel tubing - CVC oil in the chemical and volume control system exposed to an internal oil environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant’s One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds that for brass and stainless steel material exposed to an internal oil environment, loss of material is not an expected aging effect requiring management. On this basis, the project team finds that management of loss of material of the brass oil cooler shell and stainless steel tubing - CVC oil exposed to an internal oil environment in the chemical and volume control system with the One-Time Inspection Program is acceptable.

In PNP LRA Table 3.3.2-1, the applicant proposes to manage loss of preload of stainless steel fasteners exposed to both a plant indoor air external environment and a containment air external environment using PNP AMP B2.1.3, "Bolting Integrity Program."

The applicant's Bolting Integrity Program was reviewed by DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Bolting Integrity Program, the project team finds that management of loss of preload of stainless steel fasteners exposed to both a plant indoor air external environment and a containment air external environment in the chemical volume and control system is acceptable.

In PNP LRA Table 3.3.2-1, the applicant proposes to manage loss of material of stainless steel component types of letdown heat exchanger tubes, tube sheet and letdown heat exchanger tubes exposed to a treated water external environment using PNP AMP B2.1.6, "Closed Cycle Cooling Water Program" augmented by PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the Closed Cycle Cooling Water and One-Time Inspection Programs and its evaluations are documented in Sections 2.4 and 2.11 of this audit and review report. The Closed Cycle Cooling Water Program manages aging effects in closed cycle cooling water systems that are not subject to significant sources of contamination, in which water chemistry is controlled and heat is not directly rejected to the ultimate heat sink. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material of stainless steel material exposed to an external treated water environment is effectively managed using the Closed Cycle Cooling Water Program augmented by One-Time Inspection. On this basis, the project team finds that management of loss of material in the chemical volume and control system is acceptable.

In PNP LRA Table 3.3.2-1, the applicant proposes to manage the reduction of fracture toughness of cast austenitic stainless steel letdown stop valve CV-2001 exposed to a treated water internal environment using PNP AMP B2.1.6, "ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program."

The project team reviewed the ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program and its evaluation is documented in Section 2.2 of this audit and review report. The ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program facilitates inspections to identify and correct degradation in Class 1, 2, and 3 piping, components, their supports and integral attachments. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of reduction of fracture toughness of cast austenitic stainless steel material exposed to an internal treated water environment is effectively managed using the ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program. On this basis, the project team finds that management of reduction of fracture toughness in the chemical volume and control system is acceptable is acceptable.

In PNP LRA Table 3.3.2-1, the applicant proposes to manage loss of material of stainless steel flow elements exposed to an internal treated water environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of stainless steel material exposed to an internal treated water environment is effectively managed using One-Time Inspection Program. On this basis, the project team finds that management of loss of material for stainless steel flow elements exposed to an internal treated water environment in the chemical volume and control system is acceptable.

3.3.3.3 Auxiliary Systems - Circulating Water System - Summary of Aging Management Evaluation - (PNP LRA Table 3.3.2-2)

The project team reviewed PNP LRA Table 3.3.2-2, which summarizes the results of AMR evaluations for the circulating water system component groups. The results of these evaluations are all consistent with the GALL Report.

3.3.3.4 Auxiliary Systems - Component Cooling Water System - Summary of Aging Management Evaluation - (PNP LRA Table 3.3.2-3)

The project team reviewed PNP LRA Table 3.3.2-3, which summarizes the results of AMR evaluations for the component cooling water system component groups.

In PNP LRA Table 3.3.2-3, the applicant proposes to manage loss of material of carbon steel accumulators internally exposed to an air environment using PNP AMP B2.1.6, “Closed Cycle Cooling Water Program.” During the audit and review, the applicant clarified that the component type identified by this line item is the component cooling water (CCW) surge tank and addressed the internal air in the tank (above the water line). The Closed Cycle Cooling Water Program takes credit for internal one-time inspections of CCW components. During the inspection, the area above the water line in the tank will be inspected for aging degradation.

The project team reviewed the Closed Cycle Cooling Water Program and its evaluation is documented in Section 2.4 of this audit and review report. The Closed Cycle Cooling Water Program manages aging effects in closed water cooling systems that are not subject to significant sources of contamination, in which water chemistry is controlled, and heat is not directly rejected to the ultimate heat sink On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material of carbon steel accumulators exposed to an internal air environment is effectively managed using the Closed Cycle Cooling Water Program. On this basis, the project team finds that management of loss of material for carbon steel accumulators exposed to an internal air environment in the component cooling water system is acceptable.

In PNP LRA Table 3.3.2-3, the applicant proposes to manage loss of material/pitting, crevice and galvanic corrosion of nickel-based alloy materials for coolers exposed to an external treated water (CCW) environment using PNP AMPs B2.1.6, “Closed Cycle Cooling Water Program,” and B2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant’s Closed Cycle Cooling Water and One-Time Inspection Programs and its evaluations are documented in Sections 2.4 and 2.11 of this audit and review report, respectively. The Closed Cycle Cooling Water Program manages aging effects in closed cycle cooling water systems that are not subject to significant sources of contamination, in which water chemistry is controlled and heat is not directly rejected to the ultimate heat sink. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effects of loss of material of nickel-based alloy material exposed to a treated water (CCW) environment are effectively managed using the Closed Cycle Cooling Water and One-Time Inspection Programs. On this basis, the project team finds that management of loss of material for nickel-based alloy coolers externally exposed to treated water in the component cooling water system is acceptable.

In PNP LRA Table 3.3.2-3, the applicant proposes to manage loss of material of nickel-based alloy coolers exposed to an internal treated water environment using PNP AMP B2.1.13, “One-Time Inspection Program” and PNP AMP B2.1.21, “Water Chemistry Program.”

The project team reviewed the One-Time Inspection Program and the Water Chemistry Program and their evaluations are documented in Sections 2.11 and 2.17 of this audit and review report, respectively. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. The Water Chemistry Program is credited for managing aging effects such as loss of material due to general, pitting and crevice corrosion; cracking due to SCC; and steam generator tube degradation caused by denting, intergranular attack (IGA) and outer diameter stress corrosion cracking (ODSCC), by controlling the environment to which internal surfaces of systems and components are exposed. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of nickel-based alloy material exposed to an internal treated water environment are effectively managed using the One-Time Inspection Program and the Water Chemistry Program. On this basis, the project team finds that management of loss of material for nickel-based alloy coolers exposed to an internal treated water environment in the component cooling water system is acceptable.

In PNP LRA Table 3.3.2-3, the applicant proposes to manage cracking of copper alloy materials for component cooling heat exchangers exposed to an internal treated water (CCW) environment using PNP AMP B2.1.6, “Closed Cycle Cooling Water Program.”

The project team reviewed the Closed Cycle Cooling Water Program and its evaluation is documented in Section 2.4 of this audit and review report. The Closed Cycle Cooling Water Program manages aging effects in closed cycle cooling water systems that are not subject to significant sources of contamination, in which water chemistry is controlled and heat is not directly rejected to the ultimate heat sink. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of cracking of copper alloy material exposed to an internal treated water (CCW) environment are effectively managed using the Closed Cycle Cooling Water Program. On this basis, the project team finds that management of cracking of copper alloy materials for component cooling heat exchangers exposed to an internal treated water (CCW) environment in the component cooling water system is acceptable.

In PNP LRA Table 3.3.2-3, the applicant proposes to manage loss of preload of stainless steel fasteners exposed to both a plant indoor air external environment and a containment air external environment using PNP AMP B2.1.3, "Bolting Integrity Program."

The applicant's Bolting Integrity Program was reviewed by DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Bolting Integrity Program, the project team finds that management of loss of preload of stainless steel fasteners exposed to both a plant indoor air external environment and a containment air external environment in the component cooling water system is acceptable.

In PNP LRA Table 3.3.2-3, the applicant proposes to manage loss of material of copper alloy pipe and fittings and bronze valves and dampers exposed to an external containment air environment using PNP AMP B2.1.4, “Boric Acid Corrosion Program.”

The Boric Acid Corrosion Program was reviewed by NRR DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Boric Acid Corrosion Program, the project team finds that management of loss of material of copper alloy, and bronze materials for component types of pipe and fittings and valve and dampers exposed to an external containment air environment in the component cooling water system is acceptable.

During the audit and review, the project team noted that in PNP LRA Table 3.3.2-3, the applicant proposes to manage cracking and loss of material for stainless steel waste gas compressor in a gas environment using PNP AMP B2.1.6, “Closed Cycle Cooling Water Program.” In a letter dated August 27, 2005, the applicant states that cracking due to SCC/IGA is not a potential aging mechanism for the interior of the waste gas compressors (C-50A/B) cooler tubes, at PNP, due to not having temperatures > 140°F. By the August 27, 2005 letter, PNP LRA Table 3.3.2-3 is revised to delete cracking of the stainless steel waste gas compressor tubes since the aging mechanism does not exist. The compressor tubes are cooled by CCW and the tube temperature is less than 140°F. In regard to the loss of material for stainless steel waste gas compressor in a gas environment, the project team reviewed industry experience and finds that no aging effect is identified for stainless steel in a dry gas environment. However, the applicant proposes to manage loss of material for stainless steel waste gas compressor in gas with its Closed Cycle Cooling Water Program. The project team finds this acceptable because no aging effect is expected to exist.

3.3.3.5 Auxiliary Systems - Compressed Air System - Summary of Aging Management Evaluation - (PNP LRA Table 3.3.2-4)

The project team reviewed PNP LRA Table 3.3.2-4, which summarizes the results of AMR evaluations for the compressed air system component groups.

In PNP LRA Table 3.3.2-4, the applicant proposes to manage loss of material of copper alloy, brass, and bronze materials for component types of fasteners, filters/strainers, heat exchangers, pipe and fittings, and valves and dampers exposed to an external containment air and/or external plant indoor air and air environment using PNP AMP B2.1.4, “Boric Acid Corrosion Program.”

The Boric Acid Corrosion Program was reviewed by NRR DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Boric Acid Corrosion Program, the project team finds that management of loss of material of copper alloy, brass, and bronze materials for component types of fasteners, filters/strainers, heat exchangers, pipe and fittings, and valves and dampers exposed to an external containment air and/or external plant indoor air and air environment in the compressed air system is acceptable.

In PNP LRA Table 3.3.2-4, the applicant proposes to manage loss of material and/or cracking of copper alloy, bronze, brass, aluminum and stainless steel materials for component types of filters/strainers, heat exchangers, pipe and fittings, traps (steam), valves and dampers exposed to an internal air environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

During the audit and review, the project team noted that the applicant is using the One-Time Inspection Program in lieu of the Compressed Air Program, which is recommended by the GALL Report, to manage loss of material and/or cracking for the components in the compressed air system. In a letter dated August 27, 2005, the applicant states that NMC will prepare a Compressed Air Monitoring Program. The PNP LRA will be updated to describe this new program. The Compressed Air Program will be sent to the NRC for its review. The components in the compressed air system that credit the One-Time Inspection Program to manage aging effects in an internal environment of air will be changed to reference the Compressed Air Monitoring Program. On this basis and predicated on NRC acceptance of the Compressed Air Monitoring Program, the project team finds that management of loss of material and/or cracking of copper allow, bronze, brass, aluminum, and stainless steel materials in the compressed air system is acceptable. **[This is Open Item OI-3.3.1-1]**.

In PNP LRA Table 3.3.2-4, the applicant proposes to manage loss of preload of carbon steel and copper alloy fasteners exposed to both a plant indoor air external environment and a containment air external environment and stainless steel fasteners exposed to a plant indoor air external environment using PNP AMP B2.1.3, "Bolting Integrity Program."

The applicant's Bolting Integrity Program was reviewed by DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Bolting Integrity Program, the project team finds that management of loss of preload of carbon steel and copper alloy fasteners exposed to both a plant indoor air external environment and a containment air external environment and stainless steel fasteners exposed to a plant indoor air external environment in the compressed air system is acceptable.

In PNP LRA Table 3.3.2-4, the applicant proposes to manage loss of material of stainless steel filters and strainers and brass valves and dampers exposed to an internal oil and oil environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material of stainless steel and brass materials exposed to an internal oil and oil environment is effectively managed using One-Time Inspection Program. On this basis, the project team finds that management of loss of material for stainless steel filters and strainers and brass valves and dampers exposed to an internal oil and oil environment in the compressed air system is acceptable.

In Table 3.3.2-4, the applicant proposes to manage loss of material of bronze heat exchangers exposed to an internal air environment using PNP AMP B2.1.14, "Open Cycle Cooling Water Program."

The project team reviewed the Open Cycle Cooling Water Program and its evaluation is documented in Section 2.12 of this audit and review report. The Open Cycle Cooling Water Program manages aging effects caused by exposure of internal surfaces of metallic components to raw, untreated (e.g., service water). On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material of bronze heat exchangers exposed to an internal air environment is effectively managed using the Open Cycle Cooling Water Program. On this basis, the project team finds that management of loss of material for bronze heat exchangers exposed to an internal air environment in the compressed air system is acceptable.

In PNP LRA Table 3.3.2-4, the applicant proposes to manage loss of material of bronze and carbon steel heat exchangers exposed to an external and internal raw water environment using PNP AMP B2.1.14, “Open Cycle Cooling Water Program.”

The project team reviewed the Open Cycle Cooling Water Program and its evaluation is documented in Section 2.12 of this audit and review report. The Open Cycle Cooling Water Program manages aging effects caused by exposure of internal surfaces of metallic components to raw, untreated (e.g., service water). On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material of brass and carbon steel materials exposed to a raw water environment is effectively managed using the Open Cycle Cooling Water Program. On this basis, the project team finds that management of loss of material for carbon steel and bronze heat exchangers exposed to raw water in the compressed air system is acceptable is acceptable.

In PNP LRA Table 3.3.2-4, the applicant proposes to manage cracking of brass valves and dampers exposed to an oil environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of cracking of brass material exposed to an oil environment is effectively managed using One-Time Inspection Program. On this basis, the project team finds that management of cracking for brass valves and dampers exposed to an oil environment in the compressed air system is acceptable.

3.3.3.6 Auxiliary Systems - Containment Air Recirculation and Cooling System - Summary of Aging Management Evaluation - (PNP LRA Table 3.3.2-5)

The project team reviewed PNP LRA Table 3.3.2-5, which summarizes the results of AMR evaluations for the containment air recirculation and cooling system component groups.

In PNP LRA Table 3.3.2-5, the applicant proposes to manage heat transfer degradation of copper alloy containment air cooler coils exposed to an air external environment using PNP AMP B2.1.20, “System Monitoring Program.”

The applicant's System Monitoring Program was reviewed by DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the System Monitoring Program, the project team finds that management of heat transfer degradation of copper alloy containment air cooler coils exposed to an air external environment in the containment air recirculation and cooling system is acceptable.

In PNP LRA Table 3.3.2-5, the applicant proposes to manage loss of preload of stainless steel fasteners exposed to external containment air using PNP AMP 2.1.3, "Bolting Integrity Program."

The Bolting Integrity Program was reviewed by NRR DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Bolting Integrity Program, the project team finds that management of loss of preload of stainless steel fasteners exposed to external containment air in the containment air recirculation and cooling system is acceptable.

3.3.3.7 Auxiliary Systems - Emergency Power System - Summary of Aging Management Evaluation - (PNP LRA Table 3.3.2-6)

The project team reviewed PNP LRA Table 3.3.2-6, which summarizes the results of AMR evaluations for the emergency power system component groups.

In PNP LRA Table 3.3.2-6, the applicant proposes to manage loss of material/pitting, crevice and galvanic corrosion of copper alloy materials for component types of pipe and fittings exposed to an internal treated water (CCW) environment using PNP AMP B2.1.6, "Closed Cycle Cooling Water Program."

The project team reviewed the applicant's Closed Cycle Cooling Water Program and its evaluation is documented in Section 2.4 of this audit and review report. The Closed Cycle Cooling Water Program manages aging effects in closed cycle cooling water systems that are not subject to significant sources of contamination, in which water chemistry is controlled and heat is not directly rejected to the ultimate heat sink. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material/pitting, crevice and galvanic corrosion of copper alloy material exposed to an internal treated water (CCW) environment is effectively managed using the Closed Cycle Cooling Water Program. On this basis, the project team finds that management of loss of material/pitting, crevice and galvanic corrosion in the emergency power system is acceptable.

In PNP LRA Table 3.3.2-6, the applicant proposes to manage cracking and loss of material of brass, bronze, and copper alloy materials for component types of valves and dampers exposed to an internal oil environment using PNP AMP B2.1.9, "Diesel Fuel Monitoring and Storage Program" as augmented by PNP AMP B2.1.10, "Fire Protection Program" or PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the applicant's Diesel Fuel Monitoring Program, Fire Protection Program and One-Time Inspection Program and its evaluations are documented in Sections 2.7, 2.8, and 2.11 of this audit and review report, respectively. The Diesel Fuel Monitoring and Storage Program assures the continued availability and quality of fuel oil to be used in diesel generators and diesel fire pumps. The Fire Protection Program includes (a) fire barrier inspections, (b) electric and diesel-driven fire pump tests, and (c) periodic maintenance, testing, and inspection of water-based fire protection systems. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effects of cracking and loss of material of brass, bronze and copper alloy material exposed to an internal oil environment are effectively managed using the Diesel Fuel Monitoring and Storage Program as augmented by the Fire Protection Program or the One-Time Inspection Program. On this basis, the project team finds that management of cracking and loss of material in the emergency power system is acceptable.

In PNP LRA Table 3.3.2-6, the applicant proposes to manage loss of material and/or cracking of copper alloy, bronze, and brass materials for component types of heat exchangers, instrument valve assemblies and tubing, pipe and fittings, and valves and dampers exposed to an internal or external air environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the applicant's One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that for copper alloy, bronze, and brass material exposed to an internal or external air environment, loss of material is not an expected aging effect requiring management. On this basis, the project team finds that management of loss of material and cracking of copper alloy, bronze, and brass material exposed to an internal or external air environment in the emergency power system with the One-Time Inspection Program is acceptable.

In PNP LRA Table 3.3.2-6, the applicant proposes to manage loss of material of stainless steel materials for component types of pipe and fittings, and valves and dampers exposed to an internal air environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the applicant's One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that for stainless steel material exposed to an internal air environment, loss of material is not an expected aging effect requiring management. On this basis, the project team finds that management of loss of material of stainless steel material exposed to an internal air environment in the emergency power system with the One-Time Inspection Program is acceptable.

In PNP LRA Table 3.3.2-6, the applicant proposes to manage loss of material of bronze valves and dampers and stainless steel instrument valve assemblies and tubing exposed to an internal treated water environment using PNP AMP B2.1.6, “Closed Cycle Cooling Water Program.”

The project team reviewed the applicant’s Closed Cycle Cooling Water Program and its evaluation is documented in Section 2.4 of this audit and review report. The Closed Cycle Cooling Water Program manages aging effects in closed cycle cooling water systems that are not subject to significant sources of contamination, in which water chemistry is controlled and heat is not directly rejected to the ultimate heat sink. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of bronze and stainless steel materials exposed to an internal treated water environment is effectively managed using the Closed Cycle Cooling Water Program. On this basis, the project team finds that management of loss of material for bronze and stainless steel in the emergency power system is acceptable.

In PNP LRA Table 3.3.2-6, the applicant proposes to manage loss of material due to selective leaching of bronze instrument valve assemblies and tubing, cast iron traps, and brass valves and dampers exposed to an internal air environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant’s One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds that for brass, cast iron and bronze materials exposed to an internal air environment, loss of material due to selective leaching is not an expected aging effect requiring management. On this basis, the project team finds that management of loss of material of brass, cast iron and bronze materials exposed to an internal air environment in the emergency power system with the One-Time Inspection Program is acceptable.

In PNP LRA Table 3.3.2-6, the applicant proposes to manage heat transfer degradation of carbon steel coolers and carbon steel and copper alloy heat exchangers exposed to an external oil environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant’s One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds that for carbon steel and copper alloy materials exposed to an external oil environment, heat transfer degradation are not expected aging effects requiring management. On this basis, the project team finds that management of heat transfer degradation of carbon steel and copper alloy materials exposed to an external oil environment in the emergency power system with the One-Time Inspection Program is acceptable.

In PNP LRA Table 3.3.2-6, the applicant proposes to manage loss of material of cast iron pumps, stainless steel instrument valve assemblies and tubing, and stainless steel valves and dampers exposed to a fuel oil environment using PNP AMP B2.1.9, “Diesel Fuel Monitoring and Storage Program” as augmented by PNP AMP B2.1.10, “Fire Protection Program” or PNP AMP 2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant’s Diesel Fuel Monitoring Program, Fire Protection Program, and One-Time Inspection Program and their evaluations are documented in Sections 2.7, 2.8 and 2.11 of this audit and review report, respectively. The Diesel Fuel Monitoring and Storage Program assures the continued availability and quality of fuel oil to be used in diesel generators and diesel fire pumps. The Fire Protection Program includes (a) fire barrier inspections, (b) electric and diesel-driven fire pump tests, and (c) periodic maintenance, testing, and inspection of water-based fire protection systems. Periodic visual inspections of fire barrier penetration seals, fire dampers, fire barrier walls, ceilings and floors, and periodic visual inspections and functional tests of fire-rated doors are performed to ensure that functionality and operability is maintained. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds that the aging effect of loss of material of cast iron and stainless steel materials exposed to a fuel oil environment is effectively managed using the Diesel Fuel Monitoring and Storage Program, the Fire Protection Program, or the One-Time Inspection Program. On this basis, the project team finds that management of loss of material for stainless steel and cast iron materials in the emergency power system is acceptable.

In PNP LRA Table 3.3.2-6, the applicant proposes to manage loss of material due to selective leaching of copper alloy heat exchangers and cast iron pumps exposed to an internal or external oil environment using its One-Time Inspection Program.

The project team reviewed the applicant’s One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds that for copper alloy and cast iron materials exposed to an internal or external oil environment, loss of material due to selective leaching is effectively managed by the One-Time Inspection Program. On this basis, the project team finds that management of loss of material of copper alloy and cast iron materials exposed to an internal or external oil environment in the emergency power system with the One-Time Inspection Program is acceptable.

In PNP LRA Table 3.3.2-6, the applicant proposes to manage the buildup of deposits of carbon steel coolers and heat exchangers exposed to an internal raw water environment using PNP AMP B2.1.14, "Open Cycle Cooling Water Program."

The project team reviewed the Open Cycle Cooling Water Program and its evaluation is documented in Section 2.12 of this audit and review report. The Open Cycle Cooling Water

Program manages aging effects caused by exposure of internal surfaces of metallic components to raw, untreated (e.g., service water). On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that the aging effect of buildup of deposits of carbon steel material exposed to a raw water environment is effectively managed using the Open Cycle Cooling Water Program. On this basis, the project team finds that management of the buildup of deposits for carbon steel coolers and heat exchangers exposed to an internal raw water environment in the emergency power system is acceptable.

In PNP LRA Table 3.3.2-6, the applicant proposes to manage heat transfer degradation of carbon steel heat exchangers exposed to a raw water environment using PNP AMP B2.1.14, “Open Cycle Cooling Water Program.”

The project team reviewed the Open Cycle Cooling Water Program and its evaluation is documented in Section 2.12 of this audit and review report. The Open Cycle Cooling Water Program manages aging effects caused by exposure of internal surfaces of metallic components to raw, untreated (e.g., service water). On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that the aging effect of heat transfer degradation of carbon steel material exposed to a raw water environment is effectively managed using the Open Cycle Cooling Water Program. On this basis, the project team finds that management of heat transfer degradation for carbon steel heat exchangers exposed to a raw water environment in the emergency power system is acceptable.

In PNP LRA Table 3.3.2-6, the applicant proposes to manage loss of preload of stainless steel fasteners exposed to a plant indoor air external environment using PNP AMP B2.1.3, “Bolting Integrity Program.” The applicant's Bolting Integrity Program was reviewed by DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Bolting Integrity Program, the project team finds that management of loss of preload of stainless steel fasteners exposed to a plant indoor air external environment in the emergency power system is acceptable.

In PNP LRA Table 3.3.2-6, the applicant proposes to manage loss of material of galvanized filters/strainers exposed to an atmosphere/weather external environment using PNP AMP B2.1.20, “System Monitoring Program.” The applicant's System Monitoring Program was reviewed by DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the System Monitoring Program, the project team finds that management of loss of material of galvanized filters/strainers exposed to an atmosphere/weather external environment in the emergency power system is acceptable.

In PNP LRA Table 3.3.2-6, the applicant proposes to manage heat transfer degradation of carbon steel and copper alloy heat exchangers exposed to an internal or external treated water environment using PNP AMP B2.1.6, “Closed Cycle Cooling Water Program.”

The project team reviewed the Closed Cycle Cooling Water Program and its evaluation is documented in Section 2.4 of this audit and review report. The Closed Cycle Cooling Water Program manages aging effects in closed water cooling systems that are not subject to significant sources of contamination, in which water chemistry is controlled, and heat is not directly rejected to the ultimate heat sink. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that the aging effect of heat transfer degradation of carbon steel and copper alloy materials exposed to an internal or external treated water environment is effectively managed using the Closed Cycle Cooling Water Program. On this basis, the project team finds that management of heat transfer degradation for carbon steel and copper alloy heat exchangers exposed to an internal or external treated water environment in the emergency power system is acceptable.

In PNP LRA Table 3.3.2-6, the applicant proposes to manage loss of material of carbon steel valves and dampers exposed to an internal air environment using PNP AMP B2.1.9, "Diesel Fuel Oil Monitoring and Storage Program."

The project team reviewed the Diesel Fuel Oil Monitoring and Storage Program and its evaluation is documented in Section 2.7 of this audit and review report. The Diesel Fuel Oil Monitoring and Storage Program assures the continued availability and quality of fuel oil to be used in diesel generators and diesel fire pumps. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that the aging effect of loss of material of carbon steel material exposed to an internal air environment is effectively managed using the Diesel Fuel Oil Monitoring and Storage Program. On this basis, the project team finds that management of the loss of material for carbon steel valves and dampers exposed to an internal air environment in the emergency power system is acceptable.

3.3.3.8 Auxiliary Systems - Fire Protection System - Summary of Aging Management Evaluation - (PNP LRA Table 3.3.2-7)

The project team reviewed PNP LRA Table 3.3.2-7, which summarizes the results of AMR evaluations for the fire protection system component groups.

In PNP LRA Table 3.3.2-7, the applicant proposes to manage loss of material of copper alloys and brass materials for component types of sprinkler heads and pipe and fittings exposed to an external plant indoor air or containment air environment using PNP AMP B2.1.4, “Boric Acid Corrosion Program.”

The Boric Acid Corrosion Program was reviewed by NRR DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Boric Acid Corrosion Program, the project team finds that management of loss of material of copper alloys and brass materials for component types of sprinkler heads and pipe and fittings exposed to an external plant indoor air or containment air environment in the fire protection system is acceptable.

In Table 3.3.2-7, the applicant proposes to manage loss of material of cast iron valves and dampers exposed to an external atmosphere/weather environment using PNP AMP B2.1.10, "Fire Protection Program" and PNP AMP B2.1.20, "System Monitoring Program."

The project team reviewed the Fire Protection Program and its evaluation is documented in Section 2.8 of this audit and review report. The Fire Protection Program includes (a) fire barrier inspections, (b) electric and diesel-driven fire pump tests, and (c) periodic maintenance, testing, and inspection of water-based fire protection systems. The applicant's System Monitoring Program was reviewed by DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the System Monitoring Program and on the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material of cast iron valves and dampers exposed to an external atmosphere/weather environment is effectively managed using the Fire Protection and System Monitoring Programs. On this basis, the project team finds that management of loss of material of cast iron valves and dampers exposed to an external atmosphere/weather environment in the fire protection system is acceptable.

In Table 3.3.2-7, the applicant proposes to manage loss of material of cast iron filters and strainers exposed to an external plant indoor air environment using PNP AMP B2.1.20, "System Monitoring Program."

The applicant's System Monitoring Program was reviewed by DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the System Monitoring Program, the project team finds that management of loss of material of cast iron filters and strainers exposed to an external plant indoor air environment in the fire protection system is acceptable.

In Table 3.3.2-7, the applicant proposes to manage loss of material of cast iron valves and dampers exposed to an internal air environment using PNP AMP B2.1.10, "Fire Protection Program."

The project team reviewed the Fire Protection Program and its evaluation is documented in Section 2.8 of this audit and review report. The Fire Protection Program includes (a) fire barrier inspections, (b) electric and diesel-driven fire pump tests, and (c) periodic maintenance, testing, and inspection of water-based fire protection systems. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material of cast iron valves and dampers exposed to an internal air environment is effectively managed using the Fire Protection Program. On this basis, the project team finds that management of loss of material of cast iron valves and dampers exposed to an internal air environment in the fire protection system is acceptable.

In PNP LRA Table 3.3.2-7, the applicant proposes to manage loss of preload of carbon steel and stainless steel fasteners exposed to an external plant indoor air environment using PNP AMP B2.1.3, “Bolting Integrity Program.”

The Bolting Integrity Program was reviewed by NRR DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Bolting Integrity Program, the project team finds that management of loss of preload of carbon steel and stainless steel fasteners exposed to a plant indoor air environment in the fire protection system is acceptable.

In PNP LRA Table 3.3.2-7, the applicant proposes to manage loss of material of brass and cast iron valves and dampers exposed to an external plant indoor air environment using PNP AMP B2.1.4, "Boric Acid Corrosion Program" and PNP AMP B2.1.20, "System Monitoring Program."

The applicant's Boric Acid Corrosion and System Monitoring Programs were reviewed by DE and its evaluations will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Boric Acid Corrosion and System Monitoring Programs, the project team finds that management of loss of material of brass and cast iron valves and dampers exposed to an external plant indoor air environment in the fire protection system is acceptable.

In PNP LRA Table 3.3.2-7, the applicant proposes to manage the buildup of deposits of stainless steel and brass valves and dampers, and brass sprinkler heads exposed to an internal raw water environment using PNP AMP B2.1.10, "Fire Protection Program."

The project team reviewed the Fire Protection Program and its evaluation is documented in Section 2.8 of this audit and review report. The Fire Protection Program includes (a) fire barrier inspections, (b) electric and diesel-driven fire pump tests, and (c) periodic maintenance, testing, and inspection of water-based fire protection systems. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that the aging effect of buildup of deposits of stainless steel and brass valves and dampers, and brass sprinkler heads exposed to an internal raw water environment is effectively managed using the Fire Protection Program. On this basis, the project team finds that management of buildup of deposits in the fire protection system is acceptable.

In PNP LRA Table 3.3.2-7, the applicant proposes to manage loss of material of stainless steel accumulators exposed to an internal oil environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that the aging effect of loss of material of stainless steel material exposed to an internal oil environment is effectively managed using the One-Time Inspection Program. On this basis, the project team finds that management of loss of material for stainless steel accumulators exposed to an oil environment in the fire protection system is acceptable.

In PNP LRA Table 3.3.2-7, the applicant proposes to manage loss of preload of carbon steel fasteners exposed to a raw water external environment using PNP AMP B2.1.3, "Bolting Integrity Program."

The applicant's Bolting Integrity Program was reviewed by DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Bolting Integrity Program, the project team finds that management of loss of preload of carbon steel fasteners exposed to a raw water external environment in the fire protection system is acceptable.

In PNP LRA Table 3.3.2-7, the applicant proposes to manage loss of preload of carbon steel fasteners exposed to a soil external environment using PNP AMP B2.1.3, "Bolting Integrity Program."

The applicant's Bolting Integrity Program was reviewed by DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Bolting Integrity Program, the project team finds that management of loss of preload of carbon steel fasteners exposed to a soil external environment in the fire protection system is acceptable.

In PNP LRA Table 3.3.2-7, the applicant proposes to manage loss of material due to selective leaching of cast iron filters and strainers, pipe and fittings, and pumps exposed to an internal or external raw water environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the applicant's One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material due to selective leaching of cast iron materials exposed to an internal or external raw water environment is effectively managed using a program consistent with GALL AMP XI.M33, "Selective Leaching of Materials." In the PNP LRA, selective leaching is managed using the One-Time Inspection Program. On this basis, the project team finds that management of loss of material due to selective leaching of cast iron component types in the fire protection system is acceptable.

In PNP LRA Table 3.3.2-7, the applicant proposes to manage loss of material of cast iron valves and dampers exposed to an internal raw water environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material of cast iron valves and dampers exposed to an internal raw water is effectively managed using One-Time Inspection Program. On this basis, the project team finds that management of loss of material for cast iron valves and dampers exposed to an internal raw water in the fire protection system is acceptable.

In PNP LRA Table 3.3.2-7, the applicant proposes to manage loss of material due to selective leaching of cast iron valves and dampers exposed to an external soil environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the applicant's One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material due to selective leaching of cast iron materials exposed to an external soil environment is effectively managed using a program consistent with GALL AMP XI.M33, "Selective Leaching of Materials." In the PNP LRA, selective leaching is managed using the One-Time Inspection Program. On this basis, the project team finds that management of loss of material due to selective leaching of cast iron component types in the fire protection system is acceptable.

In PNP LRA Table 3.3.2-7, the applicant proposes to manage the loss of material of brass valves and dampers exposed to an internal raw water environment using PNP AMP B2.1.10, "Fire Protection Program."

The project team reviewed the Fire Protection Program and its evaluation is documented in Section 2.8 of this audit and review report. The Fire Protection Program includes (a) fire barrier inspections, (b) electric and diesel-driven fire pump tests, and (c) periodic maintenance, testing, and inspection of water-based fire protection systems. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material of brass valves and dampers exposed to an internal raw water environment is effectively managed using the Fire Protection Program. On this basis, the project team finds that management of loss of material in the fire protection system is acceptable.

3.3.3.9 Auxiliary Systems - Fuel Oil System - Summary of Aging Management Evaluation - (PNP LRA Table 3.3.2-8)

The project team reviewed PNP LRA Table 3.3.2-8, which summarizes the results of AMR evaluations for the fuel oil system component groups.

In PNP LRA Table 3.3.2-8, the applicant proposes to manage loss of material and/or cracking of copper alloy pipe and fittings and brass, bronze and stainless steel valves and dampers exposed to an internal oil environment using PNP AMP B2.1.9, “Diesel Fuel Monitoring and Storage Program” as augmented by PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant’s Diesel Fuel Monitoring and Storage Program and One-Time Inspection Program and their evaluations are documented in Sections 2.7 and 2.11 of this audit and review report, respectively. The Diesel Fuel Monitoring and Storage Program assures the continued availability and quality of fuel oil to be used in diesel generators and diesel fire pumps. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effects of loss of material and cracking of copper alloy, brass, bronze, and stainless steel materials exposed to an internal oil environment are effectively managed using the Diesel Fuel Monitoring and Storage Program as augmented by the One-Time Inspection Program. On this basis, the project team finds that management of loss of material in the fuel oil system is acceptable.

In PNP LRA Table 3.3.2-8, the applicant proposes to manage loss of material of stainless steel pipe and fittings exposed to an internal fuel oil environment using PNP AMP B2.1.9, “Diesel Fuel Monitoring and Storage Program” as augmented by PNP AMP B2.1.10, “Fire Protection Program” and PNP AMP 2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant's Diesel Fuel Monitoring and Storage Program, Fire Protection Program, and One-Time Inspection Program and their evaluations are documented in Sections 2.7, 2.8 and 2.11 of this audit and review report, respectively. The Diesel Fuel Monitoring and Storage Program assures the continued availability and quality of fuel oil to be used in diesel generators and diesel fire pumps. The Fire Protection Program includes (a) fire barrier inspections, (b) electric and diesel-driven fire pump tests, and (c) periodic maintenance, testing, and inspection of water-based fire protection systems. Periodic visual inspections of fire barrier penetration seals, fire dampers, fire barrier walls, ceilings and floors, and periodic visual inspections and functional tests of fire-rated doors are performed to ensure that functionality and operability is maintained. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that the aging effect of loss of material of stainless steel pipe and fittings exposed to an internal fuel oil environment is effectively managed using the Diesel Fuel Monitoring and Storage Program, the Fire Protection Program, and the One-Time Inspection Program. On this basis, the project team finds that management of loss of material in the fuel oil system is acceptable.

In PNP LRA Table 3.3.2-8, the applicant proposes to manage loss of material of carbon steel accumulators and pipe and fittings exposed to an internal air environment using PNP AMP B2.1.9, "Diesel Fuel Monitoring and Storage Program."

The project team reviewed the Diesel Fuel Monitoring and Storage Program and its evaluation is documented in Section 2.7 of this audit and review report. The Diesel Fuel Monitoring and Storage Program assures the continued availability and quality of fuel oil to be used in diesel generators and diesel fire pumps. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that the aging effect of loss of material of carbon steel accumulators and pipe and fittings exposed to an internal air environment is effectively managed using the Diesel Fuel Monitoring and Storage Program. On this basis, the project team finds that management of loss of material in the fuel oil system is acceptable.

3.3.3.10 Auxiliary Systems - Heating, Ventilation, and Air Conditioning System - Summary of Aging Management Evaluation - (PNP LRA Table 3.3.2-9)

The project team reviewed PNP LRA Table 3.3.2-9, which summarizes the results of AMR evaluations for the heating, ventilation, and air conditioning system component groups.

In PNP LRA Table 3.3.2-9, the applicant proposes to manage loss of material of copper alloy materials for component type of heat exchangers exposed to an external gas environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the applicant's One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that for copper alloy material exposed to an external gas environment, loss of material is not an expected aging effect requiring management. On this basis, the project team finds that management of loss of material for copper alloy materials exposed to an external gas environment in the heating, ventilation, and air conditioning system with the One-Time Inspection Program is acceptable.

In PNP LRA Table 3.3.2-9, the applicant proposes to manage loss of material of bronze and copper alloy pipe and fittings and bronze valves and dampers exposed to an external plant indoor air environment using PNP AMP B2.1.4, "Boric Acid Corrosion Program."

The Boric Acid Corrosion Program was reviewed by NRR DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Boric Acid Corrosion Program, the project team finds that management of loss of material of bronze valves and dampers and copper alloy pipe and fittings exposed to an external air environment in the heating, ventilation, and air conditioning system is acceptable.

In PNP LRA Table 3.3.2-9, the applicant proposes to manage loss of material of stainless steel materials for component types of pipe and fittings, and valves and dampers exposed to an internal air environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the applicant's One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that for stainless steel material exposed to an internal air environment, loss of material is not an expected aging effect requiring management. On this basis, the project team finds that management of loss of material of stainless steel material exposed to an internal air environment in the heating, ventilation, and air conditioning system with the One-Time Inspection Program is acceptable.

In PNP LRA Table 3.3.2-9, the applicant proposes to manage loss of material of stainless steel and carbon steel valves and dampers, cast iron traps and carbon steel pipe and fittings exposed to an internal raw water environment using PNP AMP B2.1.13, "One-Time Inspection Program." For the HVAC system, condensation has been designated as a raw water environment.

The project team reviewed the applicant's One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material of stainless steel, carbon steel, and cast iron materials exposed to an internal raw water (condensation) environment is effectively managed using the One-Time Inspection Program. On this basis, the project team finds that management of loss of material in the heating, ventilation, and air conditioning system is acceptable.

In PNP LRA Table 3.3.2-9, the applicant proposes to manage loss of material of carbon steel and copper alloy heat exchangers, carbon steel pipe and fittings and bronze valves and dampers exposed to an internal steam environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant’s One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of bronze, carbon steel, and copper alloy material exposed to an internal steam environment is effectively managed using the One-Time Inspection Program. On this basis, the project team finds management of loss of material for bronze valves and dampers, carbon steel and copper alloy heat exchangers, and carbon steel pipe and fittings in the heating, ventilation, and air conditioning system using One-Time Inspection to be acceptable.

In PNP LRA Table 3.3.2-9, the applicant proposes to manage loss of material of the component type cast iron traps exposed to an internal steam environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant’s One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of cast iron steam traps in the HVAC system exposed to an internal steam environment is effectively managed using the One-Time Inspection Program.

In PNP LRA Table 3.3.2-9, the applicant proposes to manage degradation of heat transfer of copper alloy heat exchangers exposed to an external air environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that the aging effect of degradation of heat transfer of copper alloy material exposed to an external air environment is effectively managed using One-Time Inspection Program. On this basis, the project team finds that management of degradation of heat transfer for copper alloy heat exchangers exposed to an external air environment in the heating, ventilation, and air conditioning system is acceptable.

In PNP LRA Table 3.3.2-9, the applicant proposes to manage loss of material of copper alloy heat exchangers exposed to an internal raw water environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that the aging effect of loss of material of copper alloy material exposed to an internal raw water environment is effectively managed using One-Time Inspection Program. On this basis, the project team finds that management of loss of material for copper alloy heat exchangers exposed to an internal raw water environment in the heating, ventilation, and air conditioning system is acceptable.

In PNP LRA Table 3.3.2-9, the applicant proposes to manage loss of material of carbon steel valves and dampers exposed to a steam environment using PNP AMP B2.1.13, "One-Time Inspection Program" for the internal exposure and PNP AMP B2.1.20, "System Monitoring Program" for the external exposure.

The project team reviewed the One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that the aging effect of loss of material of carbon steel material exposed to an internal steam environment is effectively managed using One-Time Inspection Program. On this basis, the project team finds that management of loss of material for carbon steel valves and dampers exposed to an internal steam environment in the heating, ventilation, and air conditioning system is acceptable.

For the external surfaces, the applicant is proposing to manage this aging effect using its System Monitoring Program. The applicant's System Monitoring Program was reviewed by DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the System Monitoring Program, the project team finds that management of loss of material of carbon steel valves and dampers exposed to an external steam environment in the heating, ventilation, and air conditioning system is acceptable.

3.3.3.11 Auxiliary Systems - Miscellaneous Gas System - Summary of Aging Management Evaluation - (PNP LRA Table 3.3.2-10)

The project team reviewed PNP LRA Table 3.3.2-10, which summarizes the results of AMR evaluations for the miscellaneous gas system component groups.

In PNP LRA Table 3.3.2-10, the applicant proposes to manage loss of material of copper alloys, bronze, and brass materials for component types of pipe and fittings, and valves and dampers exposed to a containment air or plant indoor air environment using PNP AMP B2.1.4, "Boric Acid Corrosion Program."

The Boric Acid Corrosion Program was reviewed by NRR DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Boric Acid Corrosion Program, the project team finds that management of loss of material of copper alloys, bronze, and brass materials for component types of pipe and fittings and valves and dampers exposed to a containment air or plant indoor air environment in the miscellaneous gas system is acceptable.

In PNP LRA Table 3.3.2-10, the applicant proposes to manage loss of preload and loss of material of stainless steel and copper alloy fasteners exposed to a containment air or plant air environment using PNP AMP B2.1.3, "Bolting Integrity Program."

The Bolting Integrity Program was reviewed by NRR DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Bolting Integrity Program, the project team finds that management of loss of preload and loss of material of stainless steel and copper alloy fasteners exposed to a containment air or plant air environment in the miscellaneous gas system is acceptable.

3.3.3.12 Auxiliary Systems - Radwaste System - Summary of Aging Management Evaluation - (PNP LRA Table 3.3.2-11)

The project team reviewed PNP LRA Table 3.3.2-11, which summarizes the results of AMR evaluations for the radwaste system component groups.

In PNP LRA Table 3.3.2-11, the applicant proposes to manage loss of material of copper alloy and bronze materials for component type heat exchangers exposed to a treated water (CCW) environment using PNP AMP B2.1.6, "Closed Cycle Cooling Water Program."

The project team reviewed the applicant's Closed Cycle Cooling Water Program and its evaluation is documented in Section 2.4 of this audit and review report. The Closed Cycle Cooling Water Program manages aging effects in closed cycle cooling water systems that are not subject to significant sources of contamination, in which water chemistry is controlled and heat is not directly rejected to the ultimate heat sink. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material of copper alloy and bronze materials exposed to a treated water (CCW) environment is effectively managed using the Closed Cycle Cooling Water Program. On this basis, the project team finds that management of loss of material in the radwaste system is acceptable.

In PNP LRA Table 3.3.2-11, the applicant proposes to manage loss of material of bronze materials for component types heat exchangers and pumps exposed to an external plant indoor air environment using PNP AMP B2.1.4, "Boric Acid Corrosion Program."

The Boric Acid Corrosion Program was reviewed by NRR DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Boric Acid Corrosion Program, the project team finds that management of loss of material of bronze materials for component types heat exchangers and pumps exposed to an external plant indoor air environment in the radwaste system is acceptable.

In PNP LRA Table 3.3.2-11, the applicant proposes to manage loss of material of carbon steel materials for component type pipe and fittings exposed to a gas environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant’s One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds that for carbon steel material exposed to a gas environment, loss of material is not an expected aging effect requiring management. On this basis, the project team finds that management of loss of material in the radwaste system is acceptable.

In PNP LRA Table 3.3.2-11, the applicant proposes to manage loss of material of cast iron materials for component type piping and fittings exposed to a treated water environment using PNP AMP B2.1.13, “One-Time Inspection Program.” In plant specific note 381 in the PNP LRA, the applicant states that for the radwaste system treated water is not controlled by water chemistry and can be considered as warm moist air.

The project team reviewed the applicant’s One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of cast iron material exposed to a treated water environment is effectively managed using the One-Time Inspection Program. On this basis, the project team finds that management of loss of material in the radwaste system is acceptable.

In PNP LRA Table 3.3.2-11, the applicant proposes to manage loss of material from carbon steel heat exchangers exposed to an internal steam environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of carbon steel material exposed to an internal steam environment is effectively managed using the One-Time Inspection Program. On this basis, the project team finds that management of loss of material in the radwaste system is acceptable.

In PNP LRA Table 3.3.2-11, the applicant proposes to manage loss of material of carbon steel materials for component type accumulators exposed to an internal air environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of carbon steel material exposed to an internal air environment is effectively managed using the One-Time Inspection Program. On this basis, the project team finds that management of loss of material in the radwaste system is acceptable.

In PNP LRA Table 3.3.2-11, the applicant proposes to manage loss of preload of stainless steel fasteners exposed to a plant indoor air environment using PNP AMP B2.1.3, “Bolting Integrity Program.”

The Bolting Integrity Program was reviewed by NRR DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Bolting Integrity Program, the project team finds that management of loss of preload of stainless steel fasteners exposed to a plant indoor air environment in the radwaste system is acceptable.

In PNP LRA Table 3.3.2-11, the applicant proposes to manage loss of material of carbon steel materials for component type pump exposed to an external raw water environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of carbon steel material exposed to an external raw water environment is effectively managed using the One-Time Inspection Program. On this basis, the project team finds that management of loss of material in the radwaste system is acceptable.

3.3.3.13 Auxiliary Systems - Service Water System - Summary of Aging Management Evaluation - (PNP LRA Table 3.3.2-12)

The project team reviewed PNP LRA Table 3.3.2-12, which summarizes the results of AMR evaluations for the service water system component groups.

In PNP LRA Table 3.3.2-12, the applicant proposes to manage loss of material of carbon steel materials for component type heat exchanger exposed to a gas/air internal environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant's One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that for carbon steel material exposed to a gas/air internal environment, loss of material is not an expected aging effect requiring management. On this basis, the project team finds that management of loss of material in the service water system is acceptable.

In PNP LRA Table 3.3.2-12, the applicant proposes to manage loss of preload of low-alloy steel materials for component type fasteners exposed to a containment air and plant indoor air environment using PNP AMP B2.1.3, "Bolting Integrity Program."

The Bolting Integrity Program was reviewed by NRR DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Bolting Integrity Program, the project team finds that management of loss of preload of low-alloy steel fasteners exposed to containment air and plant indoor air environment in the service water system is acceptable.

In PNP LRA Table 3.3.2-12, the applicant proposes to manage loss of material of carbon steel materials for component type heat exchanger exposed to an internal oil environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material of carbon steel materials exposed to an internal oil environment are effectively managed using One-Time Inspection Program. On this basis, the project team finds that management of loss of material in the service water system is acceptable.

In PNP LRA Table 3.3.2-12, the applicant proposes to manage cracking of rubber materials for component type pipe and fittings exposed to a plant indoor air environment using PNP AMP B2.1.20, "System Monitoring Program."

The System Monitoring Program was reviewed by NRR DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the System Monitoring Program, the project team finds that management of cracking of rubber materials for component type pipe and fittings exposed to a plant indoor air environment in the service water system is acceptable.

3.3.3.14 Auxiliary Systems - Shield Cooling System - Summary of Aging Management Evaluation - (PNP LRA Table 3.3.2-13)

The project team reviewed PNP LRA Table 3.3.2-13, which summarizes the results of AMR evaluations for the shield cooling system component groups.

In PNP LRA Table 3.3.2-13, the applicant proposes to manage loss of preload of carbon steel material for component type fasteners exposed to a containment air and plant indoor air environment using PNP AMP B2.1.3, "Bolting Integrity Program."

The Bolting Integrity Program was reviewed by NRR DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Bolting Integrity Program, the project team finds that management of loss of preload of carbon steel material for component type fasteners exposed to a containment air and plant indoor air environment in the shield cooling system is acceptable.

3.3.3.15 Auxiliary Systems - Spent Fuel Pool Cooling System - Summary of Aging Management Evaluation - (PNP LRA Table 3.3.2-14)

The project team reviewed PNP LRA Table 3.3.2-14, which summarizes the results of AMR evaluations for the spent fuel pool cooling system component groups.

In PNP LRA Table 3.3.2-14, the applicant proposes to manage loss of preload of stainless steel material for component type fasteners exposed to a containment air and plant indoor air environment using PNP AMP B2.1.3, "Bolting Integrity Program."

The Bolting Integrity Program was reviewed by NRR DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. Predicated on DE acceptance of the Bolting Integrity Program, the project team finds that management of loss of preload of stainless steel material for component type fasteners exposed to containment air and plant air environment in the spent fuel pool cooling system is acceptable.

In PNP LRA Table 3.3.2-14, the applicant proposes to manage heat transfer degradation of stainless steel material of component type spent fuel pool heat exchanger tube and tubesheet exposed to an external treated water environment using PNP AMP B2.1.6, "Closed Cycle Cooling Water Program."

The project team reviewed the applicant's Closed Cycle Cooling Water Program and its evaluation is documented in Section 2.4 of this audit and review report. The Closed Cycle Cooling Water Program manages aging effects in closed cycle cooling water systems that are not subject to significant sources of contamination, in which water chemistry is controlled and heat is not directly rejected to the ultimate heat sink. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of heat transfer degradation of stainless steel material exposed to a internal and external treated water environment is effectively managed using the Closed Cycle Cooling Water Program. On this basis, the project team finds that management of heat transfer degradation in the spent fuel pool cooling system is acceptable.

In PNP LRA Table 3.3.2-14, the applicant proposes to manage heat transfer degradation of stainless steel materials for component type spent fuel pool heat exchanger tube and tubesheet exposed to an internal treated water environment using PNP AMP B2.1.6, "Closed Cycle Cooling Water Program" and PNP AMP B2.1.21, "Water Chemistry Program."

The project team reviewed the Closed Cycle Cooling Water and the Water Chemistry Programs and its evaluations are documented in Sections 2.4 and 2.17 of this audit and review report, respectively. The Closed Cycle Cooling Water Program manages aging effects in closed cycle cooling water systems that are not subject to significant sources of contamination, in which water chemistry is controlled and heat is not directly rejected to the ultimate heat sink. The Water Chemistry Program is credited for managing aging effects such as loss-of-material due to general, pitting and crevice corrosion; cracking due to SCC; and steam generator tube degradation caused by denting, intergranular attack (IGA) and outer diameter stress corrosion cracking (ODSCC), by controlling the environment to which internal surfaces of systems and components are exposed. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of heat transfer degradation of stainless steel materials exposed to an internal treated water environment are effectively managed using the Closed Cycle Cooling Water and the Water Chemistry Programs. On this basis, the project team finds that management of heat transfer degradation in the spent fuel pool cooling system is acceptable.

3.3.3.16 Auxiliary Systems - Waste Gas System - Summary of Aging Management Evaluation - (PNP LRA Table 3.3.2-15)

The project team reviewed PNP LRA Table 3.3.2-15, which summarizes the results of AMR evaluations for the waste gas system component groups.

In PNP LRA Table 3.3.2-15, the applicant proposes to manage loss of material of carbon steel material of component types accumulator, filter/strainer, and valves and dampers exposed to an internal gas environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the applicant's One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. The project team finds that steel in an inert gas environment exhibits no aging effect and that the component or structure will therefore remain capable of performing its intended functions consistent with the CLB for the period of extended operation. This conclusion is based on the fact that gaseous corrosion (dry corrosion) usually involves reaction with high-temperature gases. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material of carbon steel material exposed to an internal gas environment is effectively managed using the One-Time Inspection Program. On this basis, the project team finds that management of loss of material in the waste gas system is acceptable.

3.3.3.17 Auxiliary Systems - Domestic Water System - Summary of Aging Management Evaluation - (PNP LRA Table 3.3.2-16)

The project team reviewed PNP LRA Table 3.3.2-16, which summarizes the results of AMR evaluations for the domestic water system component groups.

In PNP LRA Table 3.3.2-16, the applicant proposes to manage loss of material of carbon steel and cast iron materials for component type accumulators exposed to an internal air environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of carbon steel and cast iron material exposed to an internal air environment is effectively managed using the One-Time Inspection Program. On this basis, the project team finds that management of loss of material in the domestic water system is acceptable.

In PNP LRA Table 3.3.2-16, the applicant proposes to manage loss of material of cast iron materials for component type accumulator exposed to an internal treated water environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant’s One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of cast iron material exposed to an internal treated water environment is effectively managed using the One-Time Inspection Program. On this basis, the project team finds that management of loss of material in the domestic water system is acceptable.

In PNP LRA Table 3.3.2-16, the applicant proposes to manage loss of material of carbon steel materials for component type heat exchanger exposed to an internal raw water environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of carbon steel material exposed to an internal raw water environment is effectively managed using the One-Time Inspection Program. On this basis, the project team finds that management of loss of material in the domestic water system is acceptable.

In PNP LRA Table 3.3.2-16, the applicant proposes to manage loss of material of carbon steel materials for component type heat exchanger exposed to a internal steam environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant’s One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of carbon steel material exposed to an internal steam environment is effectively managed using the One-Time Inspection Program. On this basis, the project team finds that management of loss of material in the domestic water system is acceptable.

3.3.3.18 Auxiliary Systems - Chemical Addition System - Summary of Aging Management Evaluation - (PNP LRA Table 3.3.2-17)

The project team reviewed PNP LRA Table 3.3.2-17, which summarizes the results of AMR evaluations for the chemical addition system component groups.

In PNP LRA Table 3.3.2-17, the applicant proposes to manage loss of material of carbon steel material for component type accumulators exposed to an internal air environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant’s One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material exposed to an internal air environment are effectively managed using the One-Time Inspection Program. On this basis, the project team finds that management of loss of material in the chemical addition system is acceptable.

Conclusion

On the basis of its review, the project team finds 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 finds 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 PNP LRA Section 3.4 - Aging Management of Steam and Power Conversion System

In PNP LRA Section 3.4, the applicant provided the results of its AMRs for the steam and power conversion system.

In PNP LRA Tables 3.4.2-1 through 3.4.2-7, the applicant provided a summary of the AMR results for component types associated with the (1) condensate and condenser system; (2) demineralized makeup water system; (3) feedwater system; (4) heater extraction and drain system; (5) main air ejection and gland seal system; (6) main steam system; and the (7) turbine generator and crane system. The summary information for each component type included intended function; material; environment; aging effect requiring management; AMPs; the GALL Report Volume 2 item; cross reference to PNP LRA Table 3.4.1 (Table 1); and generic and plant-specific notes related to consistency with the GALL Report.

For each component type in PNP LRA Table 3.4.1, the applicant identified those component types that are managed in a manner consistent with the GALL Report, those component types for which the GALL Report recommends further evaluation, and those component types that are not addressed in the GALL Report together with the method proposed for their aging management.

The project team conducted its audit and review in accordance with SRP-LR Section 3.4.3 and the PNP audit and review plan. The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report, including LR-AMR-SPC, "Steam and Power Conversion."

3.4.1 Aging Management Review Results That Are Consistent with the GALL Report

For aging management evaluations that the applicant states are consistent with the GALL Report, the project team conducted its audit and review to determine if the applicant's reference to the GALL Report in the PNP LRA is acceptable.

The project team reviewed its assigned PNP LRA line-items to determine that the applicant (1) provides a brief description of the system, components, materials, and environment; (2) states that the applicable aging effects have been reviewed and are evaluated in the GALL Report; and (3) identifies those aging effects for the condensate and condenser system; demineralized makeup water system; feedwater system; heater extraction and drain system; main air ejection and gland seal system; main steam system; and the turbine generator system components that are subject to an AMR.

The following subparagraphs identify differences, when compared to the GALL Report, that were identified by the project team during the audit.

3.4.1.1 Loss of Material Due to Pitting and Crevice Corrosion

In the discussion section of Table 3.4.1, Item 3.4.1-07 of the PNP LRA, the applicant states that the loss of material due to pitting and crevice corrosion is managed by PNP AMP B2.1.21, "Water Chemistry Program" and PNP AMP B2.1.13, "One-Time Inspection Program." During the audit and review, the project team noted that for heat exchangers in the main steam system, the applicant is using only the One-Time Inspection Program to manage the loss of material for carbon steel exposed to steam. In a letter dated August 27, 2005, the applicant has revised the PNP LRA to add the Water Chemistry Program to manage this aging effect.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging mechanism, as recommended by the GALL Report.

3.4.1.2 Loss of Material Due to General Corrosion; Crack Initiation and Growth Due to Cyclic Loading and/or Stress Corrosion Cracking

In the discussion section of Table 3.4.1, Item 3.4.1-08 of the PNP LRA, the applicant states that the loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or stress corrosion cracking is managed by PNP AMP B2.1.3, “Bolting Integrity Program” and PNP AMP B2.1.13, “System Monitoring Program.” During the audit and review, the project team noted that the applicant is using the Bolting Integrity Program to manage the loss of pre-load for carbon steel fasteners in each of the steam and power conversion systems. For carbon steel fasteners in the steam and power conversion system, the GALL Report does not recommend managing loss of pre-load. However, in the PNP LRA, the applicant has conservatively included this aging effect and is appropriately using the Bolting Integrity Program to manage this aging effect. In a letter dated August 27, 2005, the applicant has revised the PNP LRA to change the notes from C to H and to remove the reference to Item 3.4.1-08.

On the basis of its review, the project team finds that the applicant conservatively addressed the loss of preload for carbon steel fasteners in the steam and power conversion system.

3.4.1.3 Loss of Material Due to General (Carbon Steel Only), Pitting, and Crevice Corrosion

In the discussion section of Table 3.4.1, Item 3.4.1-11 of the PNP LRA, the applicant states that the loss of material due to general (carbon steel only), pitting, and crevice corrosion is managed by PNP AMP B2.1.13, “One-Time Inspection Program” and PNP AMP B2.1.20, “System Monitoring Program.“ During the audit and review, the project team noted that for accumulators in the condensate and condenser system and the demineralized makeup water system, the applicant is using only the One-Time Inspection Program to manage the loss of material for carbon steel exposed to weather. For accumulators made of carbon steel in sun, weather, humidity and moisture, the GALL Report recommends the use of GALL AMP XI.M29, “Above Ground Carbon Steel Tanks Program.” In a letter dated August 27, 2005, the applicant has clarified that for carbon steel accumulators, its System Monitoring Program was selected to manage the external surface and the One-Time Inspection Program to manage the bottom thickness instead of GALL AMP XI.M29. Therefore, the note designation should be E rather than A and B. Also for accumulators in the demineralized makeup water system, the note designation should be E rather than C and D.

On the basis of its review, the project team finds that the applicant has selected appropriate aging management programs (System Monitoring Program for external surfaces and One-Time Inspection Program for tank bottom thickness) to address loss of material due to general (carbon steel only), pitting, and crevice corrosion for accumulators exposed to weather in the condensate and condenser system and the demineralized makeup water system.

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 finds that these AMR results are consistent with the AMRs in the GALL Report. Therefore the project team finds 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 Aging Management Review Results for Which Further Evaluation Is Recommended by the GALL Report

For some line-items assigned to the project team in PNP LRA Tables 3.4.2-1 through 3.4.2-7, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in PNP LRA Section 3.4.2.2 against the criteria provided in SRP-LR Section 3.4.2.2. The project team's assessments of these evaluations are documented in this section. These assessments are applicable to each Table 2 line-item in Section 3.4 citing the item in Table 1.

3.4.2.1 Cumulative Fatigue Damage (PNP LRA Section 3.4.2.2.1)

PNP LRA Section 3.4.2.2.1 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 TLAA is reviewed by the NRR DE staff. The evaluation of this TLAA will be addressed separately in Section 4 of the SER related to the PNP LRA.

3.4.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion (PNP LRA Section 3.4.2.2.2)

The project team reviewed PNP LRA Section 3.4.2.2.2 against the criteria in SRP-LR Section 3.4.2.2.2.

SRP-LR Section 3.4.2.2.2 states that the management of loss of material due to general, pitting, and crevice corrosion should be evaluated further for carbon steel piping and fittings, valve bodies and bonnets, pump casings, pump suction and discharge lines, tanks, tubesheets, channel heads, and shells except for main steam system components and for loss of material due to pitting and crevice corrosion for stainless steel tanks and heat exchanger/cooler tubes. The Water Chemistry Program relies on monitoring and control of water chemistry based on the guidelines contained in EPRI TR-102134 for secondary water chemistry to manage the effects of loss of material due to general, pitting, or crevice corrosion. However, corrosion may occur at locations of stagnant flow conditions. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion to verify the effectiveness of the Water Chemistry Program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In PNP LRA Section 3.4.2.2.2, the applicant addresses loss of material of piping and fittings, valve bodies and bonnets, pump casings, tanks, tubes, tubesheets, channel head and shell (except for the main steam system) due to general (carbon steel only), pitting, and crevice corrosion. The PNP LRA states that at PNP, under the One-Time Inspection Program, a representative sample of the component population will be chosen for inspection. The focus, when practical, will be placed on bounding or lead components. Factors that will be considered when choosing components for inspection are time in service, severity of operating conditions, and operating experience. The examination techniques will be visual, volumetric, or other appropriately established NDE methods that are capable of management of the aging effect loss of material due to galvanic and general corrosion, MIC, pitting and crevice corrosion, and selective leaching.

The AMPs recommended by the GALL Report are GALL AMP XI.M2, “Water Chemistry” and GALL AMP XI.M32, “One-Time Inspection” for management of this aging effect. During the audit and review, the project noted that the applicant was not using the Water Chemistry Program to manage this aging effect as recommended. In a letter dated August 27, 2005, the applicant states that the Water Chemistry Program will be added for those AMRs for which it had been omitted. With this change, the applicant has addressed the further evaluation by using the One-Time Inspection Program to verify the effectiveness of the Water Chemistry Program to manage this aging effect.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.2 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3 Loss of Material Due to General, Pitting, and Crevice Corrosion, MIC, and Biofouling (PNP LRA Section 3.4.2.2.3)

The project team reviewed PNP 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 loss of material due to general corrosion, pitting and crevice corrosion, MIC, and biofouling could occur in carbon steel piping and fittings for untreated water from the backup water supply in the auxiliary feedwater system. 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 (Appendix A.1 of the SRP-LR).

In PNP LRA Section 3.4.2.2.3, the applicant addresses loss of material of auxiliary feedwater (AFW) piping due to general, pitting, and crevice corrosion, MIC, and biofouling. The PNP LRA states that at PNP, the portion of the lines from the SWS to the auxiliary feedwater system is addressed as part of the SWS system (Item 17 of Table 3.3.1 of the SRP-LR). The aging effect of loss of material is managed by the Open Cycle Cooling Water Program. The program is consistent with GALL AMP XI.M20, “Open-Cycle Cooling Water System,” and aging effects will be managed such that SSCs within the scope of this program will continue to perform their intended functions.

The applicant also states, in the PNP LRA, that the portion of the lines from the fire protection water lines to the auxiliary feedwater system is addressed as part of the fire protection system (Item 21 of Table 3.3.1 of the SRP-LR). The aging effect of loss of material is managed by the Fire Protection Program. The program is consistent with, but includes exceptions to, GALL AMP XI.M27, "Fire Water System."

During the audit and review, the project noted that the applicant was using only the One-Time Inspection Program to manage this aging effect for carbon steel heat exchangers exposed to raw water in the feedwater system. In a letter dated August 27, 2005, the applicant states that it will add the Open Cycle Cooling Water Program for this AMR line item and to change the Table 1 reference to Item 3.4.1-09. The GALL Report recommends managing this aging effect with GALL AMP XI.M20, "Open Cycle Cooling Water System." With this change, the applicant has addressed the further evaluation by using the One-Time Inspection Program to verify the effectiveness of the Open Cycle Cooling Water Program to manage this aging effect.

During the audit and review, the project team also noted that the applicant was using only the One-Time Inspection Program to manage this aging effect for carbon steel valves and dampers exposed to raw water in the feedwater system. In a letter dated August 27, 2005, the applicant states that it will add the Open Cycle Cooling Water Program as well as the Fire Protection Program for this AMR line item and to change the Table 3.4.1 reference to Item 3.4.1-03. The GALL Report recommends managing this aging effect with a plant-specific program. With this change, the applicant has addressed the further evaluation by using the One-Time Inspection Program to verify the effectiveness of the Open Cycle Cooling Water Program and the Fire Protection Program to manage this aging effect.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.4.2.2.3 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.4 General Corrosion (PNP LRA Section 3.4.2.2.4)

The project team reviewed PNP LRA Section 3.4.2.2.4 against the criteria in SRP-LR Section 3.4.2.2.4.

SRP-LR Section 3.4.2.2.4 states that loss of material due to general corrosion could occur on the external surfaces of all carbon steel structures and components, including closure boltings, exposed to an operating temperature of less than 212°F. The GALL Report recommends further evaluation to ensure that this aging effect is adequately managed.

In PNP LRA Section 3.4.2.2.4, the applicant states that the external aging effect of general corrosion is managed by the System Monitoring Program. The external surfaces of various component types (e.g., pump casings, valve bodies, piping, etc.) are visually inspected for leakage and evidence of material degradation, such as loss of material due to corrosion. The external aging effect of general corrosion of closure boltings is managed by the Bolting Integrity Program.

The applicant further states, in the PNP LRA, that the attributes of the System Monitoring Program are consistent with the criteria described in the Branch Technical Position RLSB-1 (Appendix A.1 of the SRP-LR), and this aging effect will be managed such that the subject SSCs will continue to perform their intended functions. The applicant states in the PNP LRA that the Bolting Integrity Program is consistent with GALL AMP XI.M18, "Bolting Integrity."

The project team finds that, predicated on DE acceptance of the Bolting Integrity Program and the System Monitoring Program, the applicant has met the criteria of SRP-LR Section 3.4.2.2.3 for further evaluation.

3.4.2.5 Loss of Material Due to General, Pitting, Crevice, and MIC (PNP LRA Section 3.4.2.2.5)

3.4.2.5.1 Loss of Material Due to General, Pitting, Crevice, and MIC in AFW Pump Bearing Oil Cooler (PNP LRA Section 3.4.2.2.5.1)

The project team reviewed PNP 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 loss of material due to general corrosion (carbon steel only), pitting and crevice corrosion, and MIC could occur in stainless steel and carbon steel shells, tubes, and tubesheets within the bearing oil coolers (for steam turbine pumps) in the PWR auxiliary feedwater system. 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 (Appendix A.1 of the SRP-LR).

In PNP LRA Section 3.4.2.2.5.1, the applicant states that this paragraph of the SRP-LR is not applicable to PNP. The applicant also states in the PNP LRA that the bearing oil coolers for the auxiliary feedwater pump turbines addressed in GALL Report Items VIII.G.5-a through VIII.G.5-d are not applicable to PNP.

On the basis that the auxiliary feedwater pump turbines at PNP are not equipped with bearing oil coolers, the project team finds that this aging effect is not applicable to PNP.

3.4.2.5.2 Loss of Material Due to General, Pitting, Crevice, and MIC in Underground Condensate Piping, Tanks, and Fittings (PNP LRA Section 3.4.2.2.5.2)

The project team reviewed PNP 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 loss of material due to general corrosion, pitting and crevice corrosion, and MIC could occur in underground piping and fittings and emergency condensate storage tank in the auxiliary feedwater (AFW) system and the underground condensate storage tank in the condensate system. The Buried Piping and Tanks Inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material from general 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 PNP LRA Section 3.4.2.2.5.2, the applicant addresses loss of material of the external surface of the buried condensate storage tank and AFW piping due to general, pitting, and crevice corrosion and MIC. The PNP LRA states that PNP does not have buried storage tanks. Loss of material in buried carbon steel and stainless steel piping is managed by PNP AMP B2.1.5, "Buried Services Corrosion Monitoring Program." This program is consistent with GALL AMP XI.M34, "Buried Piping and Tanks Inspection," and will be effective in maintaining the intended functions of these underground piping systems.

On the basis that there are no buried storage tanks in the steam and power conversion system at PNP, the project team finds that, for this component type, this aging effect is not applicable to PNP. For buried carbon steel and stainless steel AFW piping, the project team finds that, based on the use of the applicant's Buried Services Corrosion Monitoring Program, the applicant has met the criteria of SRP-LR Section 3.4.2.2.5.2.

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 these issues. For these items, the project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.3 Aging Management Review Results That Are Not Consistent with the GALL Report or Not Addressed in the GALL Report

In PNP LRA Tables 3.4.2-1 through 3.4.2-7, 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.

3.4.3.1 Steam and Power Conversion System AMR Line Items with No Aging Effect (PNP LRA Tables 3.4.2-1 through 3.4.2-7)

In PNP LRA Tables 3.4.2-1 through 3.4.2-7, no item was listed unless an aging effect requiring management had been identified through the aging management review process.

During the audit and review, the project team reviewed the AMR basis documents for steam and power conversion systems. Specifically, the project team audited components having a material and environment combination for which no aging management program is recommended by the GALL Report. The project team found that every aging effect requiring management is reported in PNP LRA Tables 3.4.2-1 through 3.4.2-7. Furthermore, the project team finds that the intended functions of components within the scope of license renewal, but not requiring aging management, will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.3.2 Steam and Power Conversion System - Condensate and Condenser System - Summary of Aging Management Evaluation - (PNP LRA Table 3.4.2-1)

The project team reviewed PNP LRA Table 3.4.2-1, which summarizes the results of AMR evaluations for the condensate and condenser system component groups.

In PNP LRA Table 3.4.2-1, the applicant proposes to manage loss of material of stainless steel materials for component type of pipe and fittings exposed to an external soil environment using PNP AMP B2.1.5, “Buried Services Corrosion Monitoring Program.”

The project team reviewed the applicant’s Buried Services Corrosion Monitoring Program and its evaluation is documented in Section 2.3 of this audit and review report. The Buried Services Corrosion Monitoring Program manages aging effects on the external surfaces of carbon steel, low-alloy steel, and stainless steel components that are buried in soil or sand. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of stainless steel material exposed to an external soil environment is effectively managed using the Buried Services Corrosion Monitoring Program. On this basis, the project team finds that management of loss of stainless steel in the condensate and condenser system exposed to soil is acceptable.

In PNP LRA Table 3.4.2-1, the applicant proposes to manage loss of material (selective leaching) of cast iron materials for component type of pumps exposed to a treated water environment using PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant’s One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material (selective leaching) of cast iron materials exposed to a treated water environment is effectively managed using a program consistent with GALL AMP XI.M33, “Selective Leaching of Materials.” In the PNP LRA, selective leaching is managed using the One-Time Inspection Program. On this basis, the project team finds that management of loss of material (selective leaching) in the condensate and condenser system is acceptable.

3.4.3.3 Steam and Power Conversion System - Demineralized Makeup Water System - Summary of Aging Management Evaluation - (PNP LRA Table 3.4.2-2)

The project team reviewed PNP LRA Table 3.4.2-2, which summarizes the results of AMR evaluations for the demineralized makeup water system component groups.

In PNP LRA Table 3.4.2-2, the applicant proposes to manage loss of material from stainless steel pipe and fittings exposed to an external soil environment using PNP AMP B2.1.5, “Buried Services Corrosion Monitoring Program.”

The project team reviewed the applicant’s Buried Services Corrosion Monitoring Program and its evaluation is documented in Section 2.3 of this audit and review report. The Buried Services

Corrosion Monitoring Program manages aging effects on the external surfaces of carbon steel, low-alloy steel, and stainless steel components that are buried in soil or sand. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material of stainless steel material exposed to an external soil environment is effectively managed using the Buried Services Corrosion Monitoring Program. On this basis, the project team finds that management of loss of stainless steel in the demineralized makeup water system exposed to soil is acceptable.

3.4.3.4 Steam and Power Conversion System - Feedwater System - Summary of Aging Management Evaluation - (PNP LRA Table 3.4.2-3)

The project team reviewed PNP LRA Table 3.4.2-3, which summarizes the results of AMR evaluations for the feedwater system component groups.

In PNP LRA Table 3.4.2-3, the applicant proposes to manage cracking of stainless steel materials for component types of valves and dampers and pipe and fittings exposed to an internal treated water environment using PNP AMP B2.1.21, "Water Chemistry Program," augmented by PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the applicant's Water Chemistry Program and the One-Time Inspection Program and their evaluations are documented in Sections 2.17 and 2.11 of this audit and review report, respectively. The Water Chemistry Program is credited for managing aging effects such as loss of material due to general, pitting and crevice corrosion; cracking due to SCC; and steam generator tube degradation caused by denting, intergranular attack (IGA) and outer diameter stress corrosion cracking (ODSCC), by controlling the environment to which internal surfaces of systems and components are exposed. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of cracking of stainless steel material exposed to an internal treated water environment is effectively managed using the Water Chemistry Program and the One-Time Inspection Program. On this basis, the project team finds that management of cracking of stainless steel components exposed to treated water in the feedwater system is acceptable.

In PNP LRA Table 3.4.2-3, the applicant proposes to manage cracking of stainless steel materials for component types of valves and dampers exposed to an internal steam environment using PNP AMP B2.1.13, "One-Time Inspection Program" and PNP AMP B2.1.21, "Water Chemistry Program."

The project team reviewed the applicant's One-Time Inspection Program and the Water Chemistry Program and their evaluations are documented in Sections 2.11 and 2.17 of this audit and review report, respectively. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. The Water Chemistry Program is credited for managing aging effects such as loss-of-material due to general, pitting and crevice corrosion; cracking due to

SCC; and steam generator tube degradation caused by denting, intergranular attack (IGA) and outer diameter stress corrosion cracking (ODSCC), by controlling the environment to which internal surfaces of systems and components are exposed. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of cracking of stainless steel materials exposed to an internal steam environment is effectively managed using the One-Time Inspection Program and the Water Chemistry Program. On this basis, the project team finds that management of cracking of stainless steel components exposed to steam in the feedwater system is acceptable.

In PNP LRA Table 3.4.2-3, the applicant proposes to manage loss of material of stainless steel materials for component type of pipe and fittings exposed to an internal oil environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the applicant's One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that for stainless steel materials exposed to an internal oil environment, loss of material is not an expected aging effect requiring management. On this basis, the project team finds that management of loss of material of stainless steel components exposed to internal oil in the feedwater system with the One-Time Inspection Program is acceptable because the applicant has conservatively proposed to manage this aging effect with its One-Time Inspection Program.

In PNP LRA Table 3.4.2-3, the applicant proposes to manage loss of material of stainless steel materials for component type of pipe and fittings exposed to an external soil environment using PNP AMP B2.1.5, "Buried Services Corrosion Monitoring Program."

The project team reviewed the applicant's Buried Services Corrosion Monitoring Program and its evaluation is documented in Section 2.3 of this audit and review report. The Buried Services Corrosion Monitoring Program manages aging effects on the external surfaces of carbon steel, low-alloy steel, and stainless steel components that are buried in soil or sand. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material of stainless steel material exposed to an external soil environment is effectively managed using the Buried Services Corrosion Monitoring Program. On this basis, the project team finds that management of loss of material of stainless steel components exposed to soil in the feedwater system is acceptable.

In PNP LRA Table 3.4.2-3, the applicant proposes to manage loss of material of stainless steel materials for component type of valves and dampers exposed to an internal steam environment using PNP AMPs B2.1.13, "One-Time Inspection Program and B2.1.21, "Water Chemistry Program."

The project team reviewed the applicant's One-Time Inspection Program and the Water Chemistry Program and their evaluations are documented in Sections 2.11 and 2.17 of this audit and review report, respectively. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. The Water Chemistry Program is credited for managing aging effects such as loss of material due to general, pitting and crevice corrosion; cracking due to SCC; and steam generator tube degradation caused by denting, intergranular attack (IGA) and outer diameter stress corrosion cracking (ODSCC), by controlling the environment to which internal surfaces of systems and components are exposed. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material of stainless steel material exposed to an internal steam environment is effectively managed using the One-Time Inspection Program and the Water Chemistry Program. On this basis, the project team finds that management of loss of material of stainless steel components exposed to steam in the feedwater system is acceptable.

In PNP LRA Table 3.4.2-3, the applicant proposes to manage loss of material of carbon steel materials for component types of traps (steam), turbines and valves and dampers exposed to internal air environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the applicant's One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that for carbon steel material exposed to an internal air environment, loss of material is not an expected aging effect requiring management. On this basis, the project team finds that management of loss of material of carbon steel components exposed to air in the feedwater system with the One-Time Inspection Program is acceptable because the applicant has conservatively proposed to manage this aging effect with its One-Time Inspection Program.

In PNP LRA Table 3.4.2-3, the applicant proposes to manage loss of material (selective leaching) of cast iron materials for component types of valves and dampers exposed to a treated water environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the applicant's One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material (selective leaching) of cast iron materials exposed to a treated water environment is effectively managed using a program consistent with GALL AMP XI.M33, "Selective Leaching of Materials." In the PNP LRA, selective leaching is managed using the One-Time Inspection Program. On this basis, the project team finds that management of loss of material (selective leaching) of cast iron valves and dampers exposed to treated water in the feedwater system is acceptable.

In PNP LRA Table 3.4.2-3, the applicant proposes to manage loss of material of stainless steel materials for component types of pipe and fittings and valves and dampers exposed to a plant indoor air environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the applicant's One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that for stainless steel material exposed to a plant indoor air environment, loss of material is not an expected aging effect requiring management. On this basis, the project team finds that management of loss of material of stainless steel exposed to air in the feedwater system with the One-Time Inspection Program is acceptable.

In PNP LRA Table 3.4.2-3, the applicant proposes to manage loss of material of stainless steel materials for component type of pipe and fittings exposed to an external weather environment using PNP AMP B2.1.20, "System Monitoring Program."

The System Monitoring Program was reviewed by the NRR DE staff and will be addressed separately in Section 3 of the SER related to the PNP LRA. The System Monitoring Program is a plant-specific program that manages aging effects for normally accessible, external surfaces of piping, tanks, and other components and equipment within the scope of license renewal. Predicated on DE acceptance of the System Monitoring Program, the project team finds that management of loss of material of stainless steel exposed to weather in the feedwater system is acceptable.

3.4.3.5 Steam and Power Conversion System - Heater Extraction and Drain System - Summary of Aging Management Evaluation - (PNP LRA Table 3.4.2-4)

The project team reviewed PNP LRA Table 3.4.2-4, which summarizes the results of AMR evaluations for the heater extraction and drain system component groups.

In PNP LRA Table 3.4.2-4, the applicant proposes to manage cracking of stainless steel materials for component types of pipe and fittings and valves and dampers exposed to an internal steam environment using PNP AMP B2.1.13, "One-Time Inspection Program" and PNP AMP B2.1.21, "Water Chemistry Program."

The project team reviewed the applicant's One-Time Inspection Program and the Water Chemistry Program and their evaluations are documented in Sections 2.11 and 2.17 of this audit and review report, respectively. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. The Water Chemistry Program is credited for managing aging effects such as loss-of-material due to general, pitting and crevice corrosion; cracking due to SCC; and steam generator tube degradation caused by denting, intergranular attack (IGA) and outer diameter stress corrosion cracking (ODSCC), by controlling the environment to which internal surfaces of systems and components are exposed. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of cracking of stainless steel materials exposed to an internal steam environment is effectively managed using the One-Time Inspection Program and the Water Chemistry Program. On this basis, the project team finds that management of cracking of stainless steel exposed to steam in the heater extraction and drain system is acceptable.

In PNP LRA Table 3.4.2-4, the applicant proposes to manage the cracking of stainless steel materials for component type of transmitter/element exposed to an internal treated water environment using PNP AMP B2.1.21, "Water Chemistry Program," augmented by PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the applicant's Water Chemistry Program and the One-Time Inspection Program and their evaluations are documented in Sections 2.17 and 2.11 of this audit and review report, respectively. The Water Chemistry Program is credited for managing aging effects such as loss of material due to general, pitting and crevice corrosion; cracking due to SCC; and steam generator tube degradation caused by denting, intergranular attack (IGA) and outer diameter stress corrosion cracking (ODSCC), by controlling the environment to which internal surfaces of systems and components are exposed. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of cracking of stainless steel material exposed to an internal treated water environment is effectively managed using the Water Chemistry Program and the One-Time Inspection Program. On this basis, the project team finds that management of cracking of stainless steel exposed to treated water in the heater extraction and drain system is acceptable.

In PNP LRA Table 3.4.2-4, the applicant proposes to manage loss of material of stainless steel materials for component types of pipe and fittings and valves and dampers exposed to an internal steam environment using PNP AMP B2.1.13, "One-Time Inspection Program" and PNP AMP B2.1.21, "Water Chemistry Program."

The project team reviewed the applicant's One-Time Inspection Program and the Water Chemistry Program and their evaluations are documented in Sections 2.11 and 2.17 of this audit and review report, respectively. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. The Water Chemistry Program is credited for managing aging effects such as loss of material due to general, pitting and crevice corrosion; cracking due to SCC; and steam generator tube degradation caused by denting, intergranular attack (IGA) and outer diameter stress corrosion cracking (ODSCC), by controlling the environment to which internal surfaces of systems and components are exposed. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material of stainless steel material exposed to an internal steam environment is effectively managed using the One-Time Inspection Program and the Water Chemistry

Program. On this basis, the project team finds that management of loss of material in the heater extraction and drain system is acceptable.

In PNP LRA Table 3.4.2-4, the applicant proposes to manage loss of material of stainless steel materials for component type of transmitter/element exposed to an internal treated water environment using PNP AMP B2.1.21, “Water Chemistry Program,” augmented by PNP AMP B2.1.13, “One-Time Inspection Program.”

The project team reviewed the applicant’s Water Chemistry Program and the One-Time Inspection Program and their evaluations are documented in Sections 2.17 and 2.11 of this audit and review report, respectively. The Water Chemistry Program is credited for managing aging effects such as loss of material due to general, pitting and crevice corrosion; cracking due to SCC; and steam generator tube degradation caused by denting, intergranular attack (IGA) and outer diameter stress corrosion cracking (ODSCC), by controlling the environment to which internal surfaces of systems and components are exposed. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of stainless steel material exposed to an internal treated water environment is effectively managed using the Water Chemistry Program and the One-Time Inspection Program. On this basis, the project team finds that management of loss of material of stainless steel exposed to treated water in the heater extraction and drain system is acceptable.

In the PNP LRA (Page 3-237), the applicant is not managing the loss of material due to general corrosion for cast iron valves and dampers exposed to a plant indoor air environment. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team agrees that there is no aging effect to be managed for this material and environment combination in the heater extraction and drain system.

During the audit and review, the project team noted that the applicant was managing the loss of material due to selective leaching for cast iron valves and dampers exposed to a steam environment. In a letter dated August 27, 2005, the applicant clarified that aging effects of cast iron in a steam environment are considered to be the same as those defined for cast iron in condensate (treated water). Therefore, loss of material due to selective leaching is a valid aging effect for this component type.

The project team reviewed the applicant’s One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material (selective leaching) of cast iron materials exposed to a treated water environment is effectively managed using a program consistent with GALL AMP XI.M33, “Selective Leaching of Materials.” In the PNP LRA, selective leaching is managed using the One-Time Inspection

Program. On this basis, the project team finds that management of loss of material (selective leaching) in the heater extraction and drain system is acceptable.

3.4.3.6 Steam and Power Conversion System - Main Air Ejection and Gland Seal System - Summary of Aging Management Evaluation - (PNP LRA Table 3.4.2-5)

The project team reviewed PNP LRA Table 3.4.2-5, which summarizes the results of AMR evaluations for the main air ejection and gland seal system component groups.

In PNP LRA Table 3.4.2-5, the applicant proposes to manage loss of material of carbon steel materials for component types of blowers/fans (compressor vacuum), filters/strainers, pipe and fittings, and valves and dampers exposed to internal air environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the applicant's One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that for carbon steel material exposed to an internal air environment, loss of material is not an expected aging effect requiring management. On this basis, the project team finds that management of loss of material of carbon steel components exposed to air in the main air ejection and gland seal system with the One-Time Inspection Program is acceptable because the applicant has conservatively proposed to manage this aging effect with its One-Time Inspection Program.

During the audit and review, the project team noted that the applicant was managing the loss of material due to selective leaching for cast iron blowers/fans (compressor vacuum), and valves and dampers exposed to a steam environment. In a letter dated August 27, 2005, the applicant clarified that aging effects of cast iron in a steam environment are considered to be the same as those defined for cast iron in condensate (treated water). Therefore, loss of material due to selective leaching is a valid aging effect for this component type.

The project team reviewed the applicant's One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loss of material (selective leaching) of cast iron materials exposed to a treated water environment is effectively managed using a program consistent with GALL AMP XI.M33, "Selective Leaching of Materials." In the PNP LRA, selective leaching is managed using the One-Time Inspection Program. On this basis, the project team finds that management of loss of material (selective leaching) in the main air ejection and gland seal system is acceptable.

3.4.3.7 Steam and Power Conversion System - Main Steam System - Summary of Aging Management Evaluation - (PNP LRA Table 3.4.2-6)

The project team reviewed PNP LRA Table 3.4.2-6, which summarizes the results of AMR evaluations for the main steam system component groups.

In PNP LRA Table 3.4.2-6, the applicant proposes to manage cracking of stainless steel materials for component types of indicators/recorders, pipe and fittings, and valves and dampers exposed to an internal steam environment using PNP AMP B2.1.21, “Water Chemistry Program.”

The project team reviewed the applicant’s Water Chemistry Program and its evaluation is documented in Section 2.17 of this audit and review report. The Water Chemistry Program is credited for managing aging effects such as loss of material due to general, pitting and crevice corrosion; cracking due to SCC; and steam generator tube degradation caused by denting, intergranular attack (IGA) and outer diameter stress corrosion cracking (ODSCC), by controlling the environment to which internal surfaces of systems and components are exposed. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of cracking of stainless steel material exposed to an internal steam environment is effectively managed using the Water Chemistry Program. On this basis, the project team finds that management of cracking of stainless steel exposed to air in the main steam system is acceptable.

In PNP LRA Table 3.4.2-6, the applicant proposes to manage loss of material of stainless steel materials for component types of indicators/recorders, pipe and fittings, and valves and dampers exposed to an internal steam environment using the PNP AMP B2.1.21, “Water Chemistry Program.”

The project team reviewed the applicant’s Water Chemistry Program and its evaluation is documented in Section 2.17 of this audit and review report. The Water Chemistry Program is credited for managing aging effects such as loss of material due to general, pitting and crevice corrosion; cracking due to SCC; and steam generator tube degradation caused by denting, intergranular attack (IGA) and outer diameter stress corrosion cracking (ODSCC), by controlling the environment to which internal surfaces of systems and components are exposed. On the basis of its review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of stainless steel material exposed to an internal steam environment is effectively managed using the Water Chemistry Program. On this basis, the project team finds that management of loss of material of stainless steel exposed to steam in the main steam system is acceptable.

In PNP LRA Table 3.4.2-6, the applicant proposes to manage loss of material of copper alloy materials for component type of pipe and fittings exposed to a plant indoor air environment using PNP AMP B2.1.4, “Boric Acid Corrosion Program.”

The Boric Acid Corrosion Program was reviewed by NRR DE and its evaluation will be addressed separately in Section 3 of the SER related to the PNP LRA. The Boric Acid Corrosion Program monitors component degradation due to boric acid leakage through the performance of periodic inspections. Predicated on DE acceptance of the Boric Acid Corrosion

Program, the project team finds that management of loss of material of copper alloy materials exposed to a plant indoor air environment in the feedwater system is acceptable.

3.4.3.8 Steam and Power Conversion System -Turbine Generator System - Summary of Aging Management Evaluation - (PNP LRA Table 3.4.2-7)

The project team reviewed PNP LRA Table 3.4.2-7, which summarizes the results of AMR evaluations for the turbine generator system component groups.

In PNP LRA Table 3.4.2-7, the applicant proposes to manage loss of material of stainless steel materials for component types of accumulators and pipe and fittings exposed to an internal oil environment using PNP AMP B2.1.13, "One-Time Inspection Program."

The project team reviewed the applicant's One-Time Inspection Program and its evaluation is documented in Section 2.11 of this audit and review report. The One-Time Inspection Program addresses potentially long incubation periods for certain aging effects, including various corrosion mechanisms, cracking, and selective leaching, and provides a means of verifying that an aging effect is either not occurring or progressing so slowly as to have a negligible effect on the intended function of the structure or component. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds that for stainless steel materials exposed to an internal oil environment, loss of material is not an expected aging effect requiring management. On this basis, the project team finds that management of loss of material of stainless steel exposed to oil in the turbine generator system with the One-Time Inspection Program is acceptable.

Conclusion

On the basis of its review, the project team finds 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 finds 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 PNP LRA Section 3.5 - Aging Management of Containments, Structures, and Component Supports

In PNP LRA Section 3.5, the applicant provided the results of its AMRs for the structures and component supports.

In PNP LRA Tables 3.5.2-1 through 3.5.2-10, the applicant provided a summary of the AMR results for component types associated with the (1) auxiliary building; (2) component supports; (3) containment; (4) containment interior structures; (5) discharge structure; (6) feedwater purity building; (7) intake structure; (8) miscellaneous structural and bulk commodities; (9) switchyard and yard structures; and the (10) turbine building. The summary information for each component type included intended function; material; environment; aging effect requiring management; AMPs; the GALL Report Volume 2 item; cross reference to PNP LRA Table 3.5.1 (Table 1); and generic and plant-specific notes related to consistency with the GALL Report.

For each component type in PNP LRA Table 3.5.1, the applicant identified those component types that are managed in a manner consistent with the GALL Report, those component types for which the GALL Report recommends further evaluation, and those component types that are not addressed in the GALL Report together with the method proposed for their aging management.

The project team conducted its audit and review in accordance with SRP-LR Section 3.5.3 and the PNP audit and review plan. The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report, including basis documents, LR-AMR-CNMT, "Primary Containment Structure;" LR-AMR-STEEL, "Structural Steel Commodities;" LR-AMR-MISC, "Miscellaneous and Bulk Commodities;" LR-AMR-CMPSPT, "Component Supports;" LR-AMR-CONC, "Structural Concrete Commodities;" and LR-TR-008-MAER, "Materials Aging Effects Report, Palisades Nuclear Plant."

3.5.1 Aging Management Review Results That Are Consistent with the GALL Report

For aging management evaluations that the applicant states are consistent with the GALL Report, the project team conducted its audit and review to determine if the applicant's reference to the GALL Report in the PNP LRA is acceptable.

The project team reviewed its assigned PNP LRA line-items to determine that the applicant (1) provides a brief description of the system, components, materials, and environment; (2) states that the applicable aging effects have been reviewed and are evaluated in the GALL Report; and (3) identifies those aging effects for the auxiliary building; component supports; containment; containment interior structures; discharge structure; feedwater purity building; intake structure; miscellaneous structural and bulk commodities; switchyard and yard structures; and the turbine building components that are subject to an AMR.

The following subparagraphs identify differences, when compared to the GALL Report, that were identified by the project team during the audit and review.

3.5.1.1 Loss of Leak Tightness in Closed Position Due to Mechanical Wear of Locks, Hinges and Closure Mechanism

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-3 (Page 3-342) for component type containment shell and base slab - containment bldg., carbon steel, protected (air locks, equipment hatch, liner plate, penetrations), the GALL Report item is II.A3.2-b. GALL Report Item II.A3.2-b calls out GALL AMP XI.S4, "10 CFR Part 50, Appendix J" and plant technical specifications. The applicant listed PNP AMP B2.1.8, "Containment Leakage Testing Program." During the audit and review, the project team asked the applicant to explain why the plant technical specifications are not listed since this line item is called out as consistent with the GALL Report.

In a letter dated August 27, 2005, the applicant states that PNP Technical Specification Section 3.6 prescribes the testing requirements for the containment pressure boundary, including air locks. This should have been included in PNP LRA Table 3.5.2-3 for component type containment shell and base slab - containment bldg., carbon steel, protected (air locks, equipment hatch, liner plate, penetrations) along with the Containment Leakage Testing

Program. The AMR line item is changed to credit plant technical specifications as stated in the GALL Report.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

3.5.1.2 Loss of Sealant and Leakage Through Containment Due to Deterioration of Joint Seals, Gaskets, and Moisture Barriers

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-3 (Page 3-343) for component type containment shell and base slab - containment bldg., elastomer, protected, the GALL Report item is II.A3.3-a. GALL Report Item II.A3.3-a states that the aging effect of loss of leak tightness is monitored by 10 CFR Part 50, Appendix J leak rate tests for pressure boundary, seals and gaskets. However, on Page 3-343 of the PNP LRA, the aging effects change in material properties and cracking (which are aging mechanisms and not aging effects per the GALL Report line item) are shown as managed by PNP AMP B2.1.8, "Containment Leakage Testing Program." During the audit and review, the project team asked the applicant to explain why loss of leak tightness is not shown as an aging effect with the Containment Leakage Testing Program as the AMP and why it is shown as an AMP for change in material properties and cracking. Loss of leak tightness is shown as an aging effect on Page 3-258 of the PNP LRA.

In a letter dated August 27, 2005, the applicant states that the aging effect/mechanisms of change in material property/irradiation, thermal exposure and cracking/irradiation, thermal exposure, ultraviolet are what were evaluated based on industry guidance. The net effect of such aging effects, if not managed, is loss of pressure boundary as indicated as the intended function for this component type. The loss of pressure boundary intended function is considered equivalent to the GALL Report loss of leak tightness aging effect of GALL Report Item II.A3.3-a, so the alignment was made. The loss of leak tightness aging effect on Page 3-258 is associated with component type containment shell & base slab - containment bldg, carbon steel, protected (air locks, equipment hatch, liner plate, penetrations), shown on Page 3-342. The AMR line item is changed to add a plant-specific note to clarify that the aging effect/mechanism nomenclature used in the GALL Report is different, but the end result of the change in material properties and cracking aging effects are failure of the pressure boundary intended function; which is equivalent to loss of leak tightness.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

3.5.1.3 Loss of Material Due to Corrosion in Accessible and Inaccessible Areas

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-3 (Page 3-342) for component types containment shell and base slab - containment building carbon steel, protected, one GALL Report line item shown for loss of material is II.A1.2-a. Although the GALL Report line item discusses cleaning up borated water spills, it does not specifically call out the Boric Acid Corrosion Program to manage this cleanup. During the audit and review, the project team asked the applicant to justify stating in the notes for this Table 2 line item that the use of the Boric Acid Corrosion program to manage loss of material of the carbon steel liner is consistent with the GALL Report.

The GALL Report requires that boric acid spills are cleaned up in a timely manner. It is not specific as to how that is to be assured. During the audit and review, the applicant stated that the Boric Acid Corrosion Program is the process by which PNP implements the GALL Report requirement of ensuring boric acid spills are cleaned up in a timely manner. As such, it meets the GALL Report requirement.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

During the audit and review, the project team noted that in the further evaluation of aging management as recommended by SRP Subsection 3.5.2.2.1.4 for Table 3.5.1, Item 3.5.1-12, (Page 3-276) of the PNP LRA under Section 3.5.2.2.1.4, GALL Report Item IIA2.1-a is referenced for four conditions that must be satisfied not to need a plant-specific program. During the audit and review, the project team asked the applicant to explain why GALL Report Item IIA2.1-a is referenced for metal PWR containments instead of IIA1.2-a for prestressed concrete PWR containments.

In a letter dated August 27, 2005, the applicant states that the reference to GALL Report Item IIA2.1-a in PNP LRA Section 3.5.2.2.1.4 is a typographical error. It should be Item IIA1.2-a. This is substantiated by alignment to Item IIA1.2-a for component type containment shell and base slab - containment bldg, carbon steel, protected (air locks, equipment hatch, liner plate, penetrations) on Page 3-342 of the PNP LRA. The PNP LRA Section 3.5.2.2.1.4 is revised with Item IIA2.1-a changed to Item IIA1.2-a to correct the typographical error.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

3.5.1.4 Scaling, Cracking, and Spalling Due to Freeze-thaw; Expansion and Cracking Due to Reaction with Aggregate

During the audit and review, the project team noted that in Table 3.5.2-3 (Page 3-343) of the PNP LRA for component types containment shell and base slab - containment bldg., concrete, exposed, the aging effects requiring management are cracking, cracking and expansion, and loss of material. These are associated with PNP LRA Table 3.5.1, Item 3.5.1-16. However, in Table 2 (Page 3-342) of the PNP LRA for component types containment shell and base slab - containment bldg., concrete, below grade, the aging effects requiring management are only cracking and expansion and loss of material that are associated with PNP LRA Table 3.5.1, Item 3.5.1-16. Cracking is not shown and associated with PNP LRA Table 3.5.1, Item 3.5.1-16. During the audit and review, the project team asked the applicant to explain why cracking is not listed for below grade containment concrete and associated with PNP LRA Table 3.5.1, Item 3.5.1-16, but is listed for above grade containment concrete.

The applicant provided the following explanation. There are in fact no aging effects requiring management for the below grade concrete as discussed in the associated plant-specific notes and further evaluation sections of the PNP LRA. This is consistent with ISG-3. The GALL Report alignments for the below grade concrete are included for completeness. However, it would have been more complete, though not necessary, for the below grade concrete component type to include the alignment to PNP LRA Table 3.5.1, Item 3.5.1-16 for cracking as was done for the above grade concrete. It is worth noting that the above grade concrete is managed in accordance with ISG-3.

The applicant has shown GALL Report alignment for below grade concrete even though there are no aging effects. The aging effect cracking was inadvertently not shown. Since this aging effect does not occur, the project team finds this acceptable.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

3.5.1.5 <u>All Types of Aging Effects</u>

During the audit and review, the project team noted that in Table 3.5.2-1 (Page 3-311) of the PNP LRA for component types building framing - concrete, protected, one of the aging effects shown as requiring management is loss of strength. The GALL Report line item shown is III.A3.1-b. In the GALL Report, Item III.A3.1-b is for concrete exterior above and below grade. During the audit and review, the project team asked the applicant to explain why this component type and the GALL Report line item are associated together. This also applies to PNP LRA Table 3.5.2-1 (Page 3-316) for component type operator access component - concrete protected; to PNP LRA Table 3.5.2-6 (Page 3-354) for component type building framing - concrete, protected; to PNP LRA Table 3.5.2-9 (Page 3-377) for component type building framing-switchyard - concrete protected; to PNP LRA Table 3.5.2-10 (Page 3-382) for component type building framing-boiler buildings area-concrete, protected; to PNP LRA Table 3.5.2-10 (Page 3-386) for component type building framing-concrete, protected; to PNP LRA Table 3.5.2-10 (Page 3-389) for component type building framing-water treatment area - concrete, protected and to PNP LRA Table 3.5.2-10 (Page 3-393) for component type operator access component - concrete, protected.

In a letter dated August 27, 2005, the applicant states that the aging effect/mechanism in question is loss of strength/leaching of calcium hydroxide, the same aging effect/mechanism for GALL Report Item IIIA3.1-b. ISG-3 Item IIIA1.1-b specifies that the Structural Monitoring Program be used to inspect for evidence of leaching of calcium hydroxide. Although the aging effect is associated with a flowing water environment that is an exterior environment, PNP conservatively decided to utilize the Structural Monitoring Program to inspect the interior of exterior walls to ensure leaching of calcium hydroxide is not occurring due to ground water migration (flow) through the concrete. Accordingly, the alignment to GALL Report Item III.A3.1-b is made. The AMR line item for each of the above component types is changed to add a plant-specific note to clarify applicability of GALL Report alignment when the GALL Report environment is "flowing water" and PNP has "exposed" as the environment.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

During the audit and review, the project team noted that in Table 3.5.2-1 (Page 3-309) of the PNP LRA for component type building framing - carbon steel, protected, the material is carbon steel, the environment plant indoor air and the aging effect loss of material, which agrees with GALL Report Item III.A3.2-a. However, the AMP shown is the Boric Acid Corrosion Program instead of the Structural Monitoring Program. During the audit and review, the project team asked the applicant to explain why the note is H instead of E, consistent with the GALL Report for material, environment, aging effect but a different AMP is credited.

In a letter dated August 27, 2005, the applicant states that the aging effect/mechanism being managed by the Boric Acid Corrosion Program is loss of material/boric acid corrosion. Note H: Aging effect not in the GALL Report for this component, material, and environment combination was chosen since the GALL Report does not manage this aging mechanism for the component type. However, the aging effect of loss of material is still consistent with the GALL Report line item, so use of Note E: Consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited could also be considered appropriate. The AMR line item is revised to change Note H to Note E as discussed.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

During the audit and review, the project team noted that in Table 3.5.2-4 (Page 3-345) of the PNP LRA for component type building framing - carbon steel, protected, the material is carbon steel, the environment plant indoor air and the aging effect loss of material, which agrees with GALL Report Item III.A4.2-a. However, the AMP shown is the Boric Acid Corrosion Program instead of the Structural Monitoring Program. During the audit and review, the project team asked the applicant to explain why the note is H instead of E, consistent with the GALL Report for material, environment, aging effect but a different AMP is credited.

In a letter dated August 27, 2005, the applicant states that the aging effect/mechanism being managed by the Boric Acid Corrosion Program is loss of material/boric acid corrosion. Note H: Aging effect not in the GALL Report for this component, material, and environment combination was chosen since the GALL Report does not manage this aging mechanism for the component type. However, the aging effect of loss of material is still consistent with the GALL Report line item, so use of Note E: Consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited could also be considered appropriate. The AMR line item is revised to change Note H to Note E as discussed.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

During the audit and review, the project team noted that in Table 3.5.2-8 (Page 3-372) of the PNP LRA for component type roof flashing-auxiliary building-galvanized, exposed, the note shown is A only. During the audit and review, the project team asked the applicant to explain why Note 581 is not shown also to address galvanizing.

In a letter dated August 27, 2005, the applicant states that Note 581 would be appropriate here and for the two other galvanized component types that follow associated with the intake structure and switchyard relay house. The AMR line item for these three galvanized components is revised to add Note 581.

On the basis of its review of the applicant’s response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

During the audit and review, the project team noted that in Table 3.5.2-9 (Page 3-379) of the PNP LRA for component type tank foundations-building and yard-concrete, exposed, the environment is atmosphere/weather. For aging effect change in material properties the GALL Report Item is III.A8.1-b. The GALL Report environment for Item III.A8.1-b is flowing water. During the audit and review, the project team asked the applicant to explain how an atmosphere/weather environment is the same as a flowing water environment.

In a letter dated August 27, 2005, the applicant states that the aging effect/mechanism in question is loss of strength/leaching of calcium hydroxide, the same aging effect/mechanism for GALL Report Item IIIA8.1-b. Although flowing water is not a permanent environment for the outdoor environment, surface runoff was conservatively assumed to occur on occasion due to rainfall so it was evaluated and aligned to this line item. The AMR line item is changed to add a plant-specific note to clarify applicability of the GALL Report alignment when the GALL Report environment is “flowing water” and PNP has “exposed” as the environment.

On the basis of its review of the applicant’s response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

During the audit and review, the project team noted that in Table 3.5.2-10 (Page 3-385) of the PNP LRA for component type building framing-concrete, exposed, the environment is atmosphere/weather. For aging effect change in material properties the GALL Report Item is III.A3.1-b. The GALL Report environment for III.A3.1-b is flowing water. During the audit and review, the project team asked the applicant to explain how an atmosphere/weather environment is the same as a flowing water environment. Also applies to PNP LRA Table 3.5.2-10 (Page 3-388) for component type building framing-water treatment area - concrete, exposed.

In a letter dated August 27, 2005, the applicant states that the aging effect/mechanism in question is loss of strength/leaching of calcium hydroxide, the same aging effect/mechanism for GALL Report Item IIIA3.1-b. Although flowing water is not a permanent environment for the outdoor environment, surface runoff was conservatively assumed to occur on occasion due to rainfall so it was evaluated and aligned to this line item. The two AMR line items are changed to add a plant-specific note to clarify applicability of GALL Report alignment when the GALL Report environment is “flowing water” and PNP has “exposed” as the environment.

On the basis of its review of the applicant’s response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

3.5.1.6 Aging of Inaccessible Concrete Areas Due to Aggressive Chemical Attack, and Corrosion of Embedded Steel

During the audit and review, the project team noted that in Table 3.5.2-9 (Page 3-379) of the PNP LRA for component type tank foundations - building and yard - concrete exposed, the environment is atmosphere/weather. For aging effect cracking, loss of bond/material the GALL Report Item is III.A8.1-d and Table 3.5.1, Item 3.5.1-21. Table 3.5.1, Item 3.5.1-21 is for inaccessible concrete areas. The GALL Report environment for III.A8.1-d is exposure to aggressive environment and the component is foundation below grade. For Table 3.5.1, Item 3.5.1-21, further evaluation is provided in PNP LRA Section 3.5.2.2.2.2 (Page 3-297). It is concluded in the further evaluation that aging management of cracking, loss of bond, and loss of material due to corrosion of embedded steel for below grade inaccessible concrete is not required at PNP. During the audit and review, the project team asked the applicant to explain the rational for the AMR association between this component and GALL Report Item III.A8.1-d and Table 3.5.1, Item 3.5.1-21. Also to explain the assignment of Note A, consistent with the GALL Report.

In a letter dated August 27, 2005, the applicant states that the alignment to GALL Report Item III.A8.1-d was made due to the same component type (tank foundation) and aging effect/mechanism. It is recognized that the environments are different, but the MEAP combination is consistent with GALL Report Item IIIA1.1-d (with ISG-3 clarifications) such that the overall alignment was judged consistent. A clarifying note to that effect would have been helpful. A more appropriate alignment may have been with GALL Report Item IIIA1.1-d with a standard Note "C: Component is different, but consistent with NUREG 1801 item for material, environment and aging effect. AMP is consistent with NUREG 1801 AMP." The AMR line item is changed to add a plant-specific note to summarize the explanation given above.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

3.5.1.7 All Types of Aging Effects, Including Loss of Material Due to Abrasion, Cavitation, and Corrosion

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-5 (Page 3-349) for component type building framing - cast iron, raw water there is Note 582 which states that cast iron is considered consistent with carbon steel and is evaluated the same, but with the additional aging effect/mechanism of loss of material due to selective leaching also evaluated. During the audit and review, the project team asked the applicant to explain where in the Structural Monitoring Program selective leaching is discussed and the inspection for it.

The applicant provided the following explanation. There is a related RAI on cast iron and selective leaching (RAI 3.5.2-2-1(a)) and the Structural Monitoring Program. The response was submitted to the NRC on July 28, 2005 (ML052130137) and provides the correction that for cast iron in raw water, selective leaching is an AERM, with the PNP LRA showing the One-Time Inspection Program as the program the applicant uses to manage this aging effect.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-7 (Page 3-358) for component type building framing - concrete protected, for aging effect loss of material, GALL Report Volume 2 Item III.A6.1-a is referenced. During the audit and review, the project team asked the applicant to explain why Item III.A6.1-a is shown since it is for a weather exposed environment while the environment shown on Page 3-358 for this component type is plant indoor air.

In a letter dated August 27, 2005, the applicant states that GALL Report Item III.A6.1-a is for loss of material (spalling, scaling) and cracking/freeze-thaw. A review of the PNP AMR shows that loss of material/freeze-thaw was evaluated as not being an aging effect requiring management. Thus, there should not be a GALL Report alignment for Item III.A6.1-a. The AMR line item associated with GALL Report Item III.A6.1-a is removed from the subject component.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-7 (Page 3-358) for component type building framing - concrete protected, for aging effect loss of strength, GALL Volume 2 Item III.A6.1-b is referenced. During the audit and review, the project team asked the applicant to explain why Item III.A6.1-b is shown since it is for a flowing water environment while the environment for this component type is plant indoor air.

In a letter dated August 27, 2005, the applicant states that the aging effect/mechanism in question is loss of strength/leaching of calcium hydroxide, the same aging effect/mechanism for GALL Report Item IIIA6.1-b. ISG-3 Item IIIA1.1-b specifies that the Structural Monitoring Program be used to inspect for evidence of leaching of calcium hydroxide. Although the aging effect is associated with a flowing water environment that is an exterior environment, PNP conservatively decided to utilize the Structural Monitoring Program to inspect the interior of exterior walls to ensure leaching of calcium hydroxide is not occurring due to ground water migration (flow) through the concrete. Accordingly, the alignment to GALL Report Item III.A6.1-b is made. The AMR line item is changed to add a plant-specific note to clarify applicability of the GALL Report alignment when the GALL Report environment is flowing water and PNP has exposed as the environment.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-7 (Page 3-359) for component type flood barrier - concrete protected, for aging effect loss of strength, GALL Report Volume 2 Item III.A6.1-b is referenced. During the audit and review, the project team asked the applicant to explain why Item III.A6.1-b is shown since it is for a flowing water environment while the environment for this component type is plant indoor air.

In a letter dated August 27, 2005, the applicant states that the aging effect/mechanism in question is loss of strength/leaching of calcium hydroxide, the same aging effect/mechanism for GALL Report Item IIIA6.1-b. ISG-3 Item IIIA1.1-b specifies that the Structural Monitoring Program be used to inspect for evidence of leaching of calcium hydroxide. Although the aging effect is associated with a flowing water environment that is an exterior environment, PNP conservatively decided to utilize the Structural Monitoring Program to inspect the interior of exterior walls to ensure leaching of calcium hydroxide is not occurring due to ground water migration (flow) through the concrete. Accordingly, the alignment to GALL Report Item III.A6.1-b is made. The AMR line item is changed to add a plant-specific note to clarify applicability of GALL Report alignment when the GALL Report environment is flowing water and PNP has exposed as the environment.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

3.5.1.8 Crack Initiation and Growth from SCC and Loss of Material Due to Crevice Corrosion

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-2 (Page 3-341) for component type spent fuel storage rack - auxiliary building, stainless steel, borated water, that GALL Report Volume 2 Item III.A5.2-b and PNP LRA Table 3.5.1, Item 3.5.1-23 were not associated with this component and a Note C assigned. During the audit and review, the project team asked the applicant to explain why GALL Report Volume 2 Item III.A5.2-b and PNP LRA Table 3.5.1, Item 3.5.1-23 were not associated with this component and Note C assigned.

In a letter dated August 27, 2005, the applicant states that the spent fuel storage rack, auxiliary building, stainless steel, borated water is aligned to GALL Report Item VII.A2.1-c since it is the appropriate component match (spent fuel storage racks). The associated GALL Report aging effect/mechanism (crack initiation and growth/SCC), however, is not applicable since PNP SFP temperatures are below the temperature threshold for the effect. However, PNP is managing loss of material due to crevice/pitting corrosion. Thus, Note H, aging effect not in the GALL Report for this component, was utilized. Item III.A5.2-b with Note C would also be applicable, however, since it is the same material, environment, aging effect, program (MEAP) combination, but it is a different component. The AMR line item is changed to align with GALL Report Item III.A5.2-b with Note C for the subject component.

On the basis of its review of the applicant's response, the project team finds the response acceptable since the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

3.5.1.9 Cracking Due to Restraint, Shrinkage, Creep, and Aggressive Environment

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-4 (Page 3-347) for component type high energy line break/moderate energy line break (HELB/MELB) component - concrete, protected the associated GALL Report, Revision 1, Volume 2, Item III.A3-11, which is for masonry walls. During the audit and review, the project team asked the applicant to explain that if the subcomponent is masonry walls, why GALL Report Volume 2 Item III.A3.3-a is not shown for this PNP LRA AMR with a different note other than H.

In a letter dated August 27, 2005, the applicant states that the project team's observation that the cracking aging effect with a standard Note H is associated with a masonry block wall is correct. Accordingly, the appropriate GALL Report alignment for this AERM should be to GALL Report Volume 2 (Revision 0) Item III.A3.3-a with a standard Note A rather than to no GALL Report line item with a Note H as indicated in the PNP LRA Table 3.5.2-4. The AMR line item is changed to add the GALL Report line item with Note A as discussed. Also, block walls is added to the component description in PNP LRA Table 3.5.2-4 for the subject component. The changes also apply to component type “Building Framing - Concrete, Protected.”

On the basis of its review of the applicant’s response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-1 (Page 3-313) for component type HELB/MELB component - concrete, protected, the aging effect is cracking with the referenced GALL Report Volume 2 Item III.A3.3-a and Table 3.5.1, Item 3.5.1-24. These reference items are for masonry walls. During the audit and review, the project team asked the applicant to explain why the component type has no mention of masonry walls like other component types in Table 2. This also applies to PNP LRA Table 3.5.2-1 (Page 3-316) for component type operator access component - concrete protected; to PNP LRA Table 3.5.2-7 (Page 3-357) for component type building framing - concrete, exposed; to PNP LRA Table 3.5.2-7 (Page 3-358) for component type building framing - concrete, protected; to PNP LRA Table 3.5.2-10 (Page 3-388) for component type building framing - water treatment area - concrete, exposed and to PNP LRA Table 3.5.2-10 (Page 3-393) for component type operator access component - concrete protected.

In a letter dated August 27, 2005, the applicant states that as is evident from the component type naming scheme, PNP scoped civil/structural components based on design attributes, building, material, and environment. For the concrete elements, concrete and masonry block walls were grouped together rather than separated. Thus, aging effects for both component types were evaluated where the component type includes, or could include, masonry walls. The examples listed in parentheses in the component type title in the PNP LRA are representative, but not necessarily fully inclusive, of all included structural members in the component group. All components identified in the question include masonry walls.

On the basis of its review of the applicant’s response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

3.5.1.10 <u>Cracks, Distortion and Increases in Component Stress Level Due to Settlement</u>

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-1 (Page 3-309) for component type building framing - concrete, below grade, one GALL Report item shown for cracking is III.A3.1-h. The PNP LRA states that no aging management program is required. However, for building framing - concrete, exposed, this same possible cracking is monitored by the Structural Monitoring Program. During the audit and review, the project team asked the applicant to explain how concrete cracking can occur above grade from settlement but not below grade if settlement of the auxiliary building foundation at PNP does not occur at all. Also, this applies to Table 3.5.2-1 (Page 3-311) for component type building framing - concrete, protected; to Table 3.5.2-6 (Page 3-353) for component type building framing - concrete, exposed; to Table 3.5.2-6 (Page 3-354) for component type building framing - concrete, protected; to Table 3.5.2-9 (Page 3-376) for component type building framing - switchyard - concrete, exposed; to Table 3.5.2-9 (Page 3-377) for component type building framing - switchyard - concrete, protected; to Table 3.5.2-9 (Page 3-378) for component type missile shield - yard - concrete, exposed; to Table 3.5.2-10 (Page 3-381) for component type building framing - boiler buildings area - concrete, exposed; to Table 3.5.2-10 (Page 3-382) for component type building framing - boiler buildings area - concrete, protected; to Table 3.5.2-10 (Page 3-385) for component type building framing - concrete, exposed; to Table 3.5.2-10 (Page 3-386) for component type building framing - concrete, protected; to Table 3.5.2-10 (Page 3-388) for component type building framing - water treatment area - concrete, exposed; to Table 3.5.2-10 (Page 3-389) for component type building framing - water treatment area - concrete, protected; to Table 3.5.2-10 (Page 3-391) for component type HVAC component - concrete, protected; to Table 3.5.2-10 (Page 3-392) for component type missile shield - concrete, exposed; to Table 3.5.2-10 (Page 3-392) for component type missile shield - concrete, protected; and to Table 3.5.2-10 (Page 3-393) for component type operator access component - concrete, protected.

In a letter dated August 27, 2005, the applicant states that GALL Report Item III.A3.1-h is considered to be similar to GALL Report Item IIIA1.1-a that has an aging effect/mechanism of loss of material (spalling, scaling) and cracking/freeze-thaw. Accordingly, guidance was taken from ISG-3 Item IIIA1.1-a wherein inaccessible areas are exempted from inspections if air content requirements are met, subsequent inspections did not find freeze-thaw degradations, and provided that the Structures Monitoring Program is used to inspect accessible concrete for cracking due to freeze-thaw. PNP therefore is including inspections for cracking/freeze-thaw of accessible concrete in the scope of the Structural Monitoring Program and, since PNP meet the other criteria, inspections of inaccessible concrete is not required. Plant-specific Note 547 explains this in the PNP LRA. Since it is not specifically referenced for the examples quoted, each AMR line item for the subject components above is changed to add Note 547.

The applicant added Note 547 to each AMR line item in the question. The project team finds that the note correctly provides the explanation for why some inspections are not performed.

On the basis of its review of the applicant’s response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

During the audit and review, the project team noted that in the discussion for PNP LRA Table 3.5.1, Item 3.5.1-25, the referenced PNP LRA section for further evaluation is 3.5.2.2.1.2, which is for the containment. During the audit and review, the project team asked the applicant to explain why Section 3.5.2.2.2.1 of the PNP LRA is not referenced for further evaluation of Groups 1-3, 5, 7-9 (Class 1 structures).

In a letter dated August 27, 2005, the applicant states that SRP Table 3.5.1 line item 25 incorrectly references Section 3.5.2.2.1.2 for the non-containment structures when in fact Section 3.5.2.2.2.1 is the appropriate SRP (and PNP LRA) section. Therefore, Table 3.5.1 line item 25 should refer to PNP LRA Section 3.5.2.2.2.1 for the Class 1 structures instead. The discussion for Table 3.5.1 line item 25 is revised to show the correct PNP LRA section for further evaluation.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

3.5.1.11 Reduction in Foundation Strength Due to Erosion of Porous Concrete Subfoundation

During the audit and review, the project team noted that in the discussion for PNP LRA Table 3.5.1, Item 3.5.1-26, the referenced PNP LRA section for further evaluation is 3.5.2.2.1.2, which is for the containment. During the audit and review, the project team asked the applicant to explain why Section 3.5.2.2.2.1 of the PNP LRA is not referenced for further evaluation of Groups 1-3, 5, 7-9 (Class 1 structures).

In a letter dated August 27, 2005, the applicant states that SRP Table 3.5.1 line item 26 incorrectly references Section 3.5.2.2.1.2 for the non-containment structures when in fact Section 3.5.2.2.2.1 is the appropriate SRP (and PNP LRA) section. Therefore, Table 3.5.1 line item 26 should refer to PNP LRA Section 3.5.2.2.2.1 for the Class 1 structures instead. The discussion for Table 3.5.1 line item 26 is revised to show the correct PNP LRA section for further evaluation.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

3.5.1.12 Reduction in Strength and Modulus Due to Elevated Temperature

During the audit and review, the project team noted that in the discussion for PNP LRA Table 3.5.1, Item 3.5.1-27, the referenced PNP LRA section for further evaluation is 3.5.2.2.1.3, which is for the containment. During the audit and review, the project team asked the applicant to explain why Section 3.5.2.2.2.1 of the PNP LRA is not referenced for further evaluation of Groups 1-5 (Class 1 structures).

In a letter dated August 27, 2005, the applicant states that SRP Table 3.5.1 line item 27 incorrectly references Section 3.5.2.2.1.3 for the non-containment structures when in fact Section 3.5.2.2.2.1 is the appropriate SRP (and PNP LRA) section. Therefore, Table 3.5.1 line item 27 should refer to PNP LRA Section 3.5.2.2.2.1 for the Class 1 structures instead. The discussion for Table 3.5.1 line item 27 is revised to show the correct PNP LRA section for further evaluation.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

3.5.1.13 Aging of Component Supports

During the audit and review, the project team noted that in Table 3.5.2-2 (Page 3-333) of the PNP LRA for component type non-ASME piping and mechanical component support - boiler building, concrete protected, the aging effect is loss of material with the referenced GALL Report Items III.B2.2-a and III.B4.3-a and Table 3.5.1, Item 3.5.1-29. GALL Report Items

III.B2.2-a and III.B4.3-a are associated with the material of concrete and the aging effect of reduction in concrete anchor capacity. During the audit and review, the project team asked the applicant to explain how the PNP LRA Table 2 line item for this component can list the material as carbon steel and the aging effect as loss of material and still show Note A, consistent with the GALL Report.

In a letter dated August 27, 2005, the applicant states that the carbon steel material shown for this comment is a typographical error. It should be shown as concrete, as it was evaluated and summarized in the AMR. The AMR line item is revised to change carbon steel to concrete as discussed.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-10 (Page 3-392) for component type missile shield - concrete, exposed, for aging effect reduction in concrete anchor capacity GALL Report Item III.B5.2-a is shown. Note A is shown, consistent with the GALL Report. However, concrete at locations of expansion and grouted anchors, etc. is not shown in the component type like it is for other similar PNP LRA AMR line items. During the audit and review, the project team asked the applicant to explain why concrete locations of expansion and grouted anchors is not shown under the component type column if this AMR line item is to be consistent with the GALL Report. This also applies to component type missile shield - concrete protected on PNP LRA Page 3-392; to component type missile shield - yard - concrete exposed on PNP LRA Page 3-378 and to component type HVAC component -concrete protected on PNP LRA Page 3-391.

In a letter dated August 27, 2005, the applicant states that as is evident from the component type naming scheme, PNP scoped civil/structural components based on design attributes, building, material, and environment. For the concrete elements, concrete was used generically and includes concrete at locations of expansion and grouted anchors. Thus, aging effects for concrete and concrete at expansion and grouted anchors were both evaluated. The examples listed in parentheses in the component type title in the PNP LRA are representative, but not necessarily fully inclusive, of all included structural members in the component group. All components identified in the question include concrete at locations of expansion and grouted anchors.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-1 (Page 3-309) for component building framing - carbon steel protected, one of the AMPs to manage loss of material is the Structural Monitoring Program. GALL Report Item III.B5.1-a is shown here corresponding to Table 3.5.1, Item 3.5.1-31. However, GALL Report Volume 1 Table 5 does not relate Item III.B5.1-a to 3.5.1-31 but to Item 3.5.1-29. During the audit and review, the project team asked the applicant to explain why PNP LRA Table 3.5.1, Item 3.5.1-31 is shown related to GALL Report Item III.B5.1-a.

In a letter dated August 27, 2005, the applicant states that PNP LRA Table 2 Item 3.5.1-31 is a typographical error. The appropriate alignment should be shown as Item 3.5.1-29 in the AMR. The AMR line item is revised to change 3.5.1-31 to 3.5.1-29 as discussed.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

3.5.1.14 Loss of Material Due to Boric Acid Corrosion

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-4 (Page 3-345) for component type building framing - carbon steel, protected, the aging effect is loss of material with the referenced GALL Report Volume 2 Item III.B5.1-b and Table 3.5.1, Item 3.5.1-29. GALL Report Item III.B5.1-b is associated with Table 3.5.1, Item 3.5.1-31 in GALL Report Table 5. During the audit and review, the project team asked the applicant to explain why Table 3.5.1, Item 3.5.1-29 is shown for this component AMR instead of item 3.5.1-31.

In a letter dated August 27, 2005, the applicant states that Table 2 Item 3.5.1-29 is a typographical error. The appropriate alignment should be shown as Item 3.5.1-31 in the AMR. The AMR line item is revised to change 3.5.1-29 to 3.5.1-31, as discussed.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2.-1 (Page 3-315) for component operator access component - carbon steel, protected, one of the AMPs to manage loss of material is the Boric Acid Corrosion Program. The applicant has shown Note A for this line item. However, in the same table on Page 3-316 for component operator access component - galvanized, protected, the applicant has used Note C for the same aging effect and AMP combination. During the audit and review, the project team asked the applicant to explain why the first referenced line item has Note A and the second Note C when the only difference in components appears to be galvanizing.

In a letter dated August 27, 2005, the applicant states that the use of Note C was conservative since, as the reviewer notes, the only difference is the galvanizing. As Note 581 that aligns with "Operator Access Component - Galvanized, Protected" states, "Galvanized material is treated the same as carbon steel. No credit is taken for the galvanized coating." Thus, Note A could have been used. The AMR line item is revised to change the note from C to A.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2.-2 (Page 3-317) for component ASME Class 1 tubing support - auxiliary building, carbon steel, protected, one of the AMPs to manage loss of material is the Boric Acid Corrosion Program. GALL Report Item III.B1.1.1-b is shown here corresponding to PNP LRA Table 3.5.1, Item 3.5.1-31. However, Note 583 shown for this line item does not relate to Item III.B1.1.1-b but to

Item III.B5.1-b. During the audit and review, the project team asked the applicant to explain why Note 583 is shown for this line item.

In a letter dated August 27, 2005, the applicant explains that the statement in Note 583 is also applicable to GALL Report Item B1.1.1-b. It would have been more appropriate to not have included the specific GALL Report line item reference (i.e., GALL Report Item III.B5-1b) and kept it generic (i.e., GALL Report) so as to be useful for similar circumstances. Note 583 is revised to remove the specific GALL Report line item reference from it.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2.-2 (Page 3-318) for component ASME Class 2 and 3 piping and mechanical component support - auxiliary building, carbon steel, protected, one of the AMPs to manage loss of material is the Boric Acid Corrosion Program. GALL Report Item III.B1.2.1-b is shown here corresponding to PNP LRA Table 3.5.1, Item 3.5.1-31. However, Note 583 shown for this line item does not relate to Item III.B1.2.1-b but to Item III.B5.1-b. During the audit and review, the project team asked the applicant to explain why Note 583 is shown for this line item. This also applies to the same galvanized component on Page 3-319 of the PNP LRA; to component electrical component support - auxiliary building, carbon steel, protected, on Page 3-324; to component type electrical component support - auxiliary building, galvanized, protected, on Page 3-326; to component non-ASME piping and mechanical component support - auxiliary building, carbon steel, protected, on Page 3-331 and to component non-ASME piping and mechanical component support - auxiliary building, galvanized, protected, on Page 3-332.

In a letter dated August 27, 2005, the applicant explains that the statement in Note 583 is also applicable to GALL Report Items IIIB1.2.1-b, IIIB2.1-b, IIIB3.1-b, and IIIB4.1-b that are aligned to the examples given above. It would have been more appropriate to not have included the specific GALL Report line item reference (i.e., GALL Report Item III.B5-1b) and kept it generic (i.e., GALL Report) so as to be useful for similar circumstances. Note 583 is revised to remove the specific GALL Report line item reference from it.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2.-4 (Page 3-348) for component HVAC component - carbon steel, protected, one of the AMPs to manage loss of material is the Boric Acid Corrosion Program. GALL Report Item III.B5.1-b is shown here corresponding to PNP LRA Table 3.5.1, Item 3.5.1-31. During the audit and review, the project team asked the applicant to explain why GALL Report Item III.B4.1-b is not shown for this line item and the Note A instead of C. This also applies to the same galvanized component on Page 3-348.

In a letter dated August 27, 2005, the applicant states that a more appropriate GALL Report alignment would have been to GALL Report Item IIIB4.1-b with a Note A rather than Item

IIIB5.1-b. The AMR line item is revised to change the GALL Report line item and note as discussed.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

3.5.1.15 Loss of Material Due to Environmental Corrosion; Loss of Mechanical Function Due to Corrosion, Distortion, Dirt, Overload, etc.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2.-2 (Page 3-317) for component ASME Class 1 tubing support - auxiliary building, carbon steel protected, one of the GALL Report items shown is III.B1.1.1-a. GALL Report Item III.B1.1.1-a states that the environment is inside containment. During the audit and review, the project team asked the applicant to justify assigning Note A (consistent with the GALL Report) for this Table 2 line item when the component is in the auxiliary building and not in the containment.

In a letter dated August 27, 2005, the applicant states that both the auxiliary building and containment environments are indoor air environments. There is little difference between the two environments other than temperature and radiation exposure. The auxiliary building environment then, is equivalent to or slightly less harsh than the containment. Since the material, environment, aging effect, and program are consistent with GALL Report Item IIIB1.1.1-a, assignment of the note was deemed appropriate. Table 2 of the PNP LRA is revised to include a plant-specific note for the line item to provide the clarification of why the environments are equivalent.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

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 audit and review, the project team finds that all other AMR results that the applicant identified as consistent with the GALL Report are consistent with the AMRs in the GALL Report. Therefore the project team finds 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 Aging Management Review Results for Which Further Evaluation Is Recommended by the GALL Report

For some line-items assigned to the project team in PNP LRA Tables 3.5.2-1 through 3.5.2-10, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in PNP LRA Section 3.5.2.2 against the criteria provided in 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 line-item in Section 3.5 citing the item in Table 1.

3.5.2.1 PWR Containment (PNP LRA Section 3.5.2.2.1)

The project team reviewed PNP LRA Section 3.5.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.1, which addresses several areas discussed below.

3.5.2.1.1 Aging of Inaccessible Concrete Areas (PNP LRA Section 3.5.2.2.1.1)

The project team reviewed PNP 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 cracking, spalling, and increases in porosity and permeability due to leaching of calcium hydroxide and aggressive chemical attack; and cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel could occur in inaccessible areas of concrete and steel containments. The GALL Report recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific criteria defined in the GALL Report cannot be satisfied.

In PNP LRA Section 3.5.2.2.1.1, the applicant addresses aging of the containment concrete foundation, walls and dome due to leaching of calcium hydroxide, aggressive chemical attack, and corrosion of embedded steel. The following indented paragraphs are extracted from the PNP LRA. **The project team's evaluation is provided at the end of the indented paragraphs**. In the PNP LRA, the applicant states the following:

> (1) Loss of Material and Cracking Due to Freeze-Thaw
>
> Accessible Areas: In accordance with the GALL Report, as revised by ISG-3, accessible reinforced concrete structures and components will be monitored by the Containment Inservice Inspection Program to manage loss of material (spalling, scaling) and cracking due to freeze-thaw.
>
> Inaccessible Areas: PNP is located in an area with severe weathering conditions as noted on Figure 1 of ASTM C33-99. Freeze-thaw is not considered an aging mechanism for concrete components below the frost line (depth of 42 inches, per Michigan Building Code).
>
> Discussion: The PNP concrete structures and concrete are designed in accordance with ACI 318-63 and 71, and constructed using ingredients conforming to ACI and ASTM standards. PNP specifications require all concrete to contain an air-entraining agent in sufficient quantity to maintain specified percentages based on nominal maximum size aggregate. For severe weather exposures, the air content identified varies from three to five percent. Containment replacement concrete for steam generator replacement access had three to seven percent air entrainment specified. Water/cement ratios for concrete mixes range from 0.44 for the 5000 psi concrete and 0.45 to 0.46 for the 4000 psi concrete mix designs used in the primary containment construction (PNP FSAR Section 5.8.7.1), and 0.33 for 5000 psi concrete used for closing the

opening in the shell for steam generator replacement (PNP FSAR Section 5.8.9.3.1.4).

Review of Operating Experience and Maintenance Rule Structures Monitoring results confirmation that freeze-thaw degradation of PNP's concrete has not occurred.

As described in NUREG-1557, "Summary of Technical Information and Agreements from Nuclear Management and Resources Council [NUMARC] Industry Reports Addressing License Renewal," freeze-thaw does not cause loss of material from reinforced concrete in foundations, and in above and below grade exterior concrete, for plants located in a geographic region of negligible weathering conditions (weathering index <100 day-inch/year). Similarly, freeze-thaw damage is not significant for reinforced concrete in foundations, and in above and below grade exterior concrete, for plants located in areas in which weathering conditions are considered severe (weathering index >500 day-inch/year) or moderate (100-500 day-inch/year), provided that the concrete mix design meets the air content (entrained air 3-6%) and water-to-cement ratio (0.35-0.45) specified in ACI 318-63 or ACI 349-85. PNP water-cement ratios range between 0.33 and 0.46, and ACI 201.2R-77 Section 1.4.2 recommends a not to exceed water-cement ratio of 0.50 for other than "thin" structures. In addition, at PNP, the ground tends to freeze and stay frozen through the winter, which means that below grade concrete is only exposed, essentially, to one freeze-thaw cycle in a typical year. Since damage to concrete from freeze-thaw is related to repeated cycles of freeze-thaw as noted from industry guidance, and no evidence of freeze-thaw damage has been identified in exposed concrete which is subjected to repeated cycles, it is concluded that below grade concrete will not experience damage or degradation.

In conclusion, since these conditions for PNP concrete are satisfied, aging management is not required for below grade concrete.

(2) Increase in Porosity, Permeability, and Loss of Strength Due to Leaching of Calcium Hydroxide

Accessible Areas: In accordance with the GALL Report, as revised by ISG-3, accessible reinforced concrete structures and components will be monitored by the Containment Inservice Inspection Program to manage increase in porosity and permeability, and loss of strength due to leaching of calcium hydroxide.

Inaccessible Areas (Containment Shell and Basemat Concrete): The PNP concrete structures and concrete components are designed in accordance with ACI 318-63 and constructed using ingredients conforming to ACI and ASTM standards, which provide for good quality, dense, well cured, and low permeability concrete. Cracking is controlled through proper arrangement and distribution of reinforcing bars.

Concrete structures and concrete components are constructed of a dense, well-cured concrete with an amount of cement suitable for strength development, and achievement of a water-to-cement ratio (PNP water/cement ratio 0.45), which is characteristic of concrete having low permeability. This is consistent with the recommendations and guidance provided by ACI 201.2R-77.

In addition, concrete components must be exposed to flowing water through the concrete component in order for leaching to be an issue. Ground water elevation is Elev. 580', with primary containment basement floor at Elev. 590'. In addition, the containment bottom/floor has a ¼" thick, steel liner plate welded to embedments and covered with 18" concrete, further reducing the likelihood of water flowing through the floor.

Natural groundwater movement in this area is from the plant site to Lake Michigan. The rate of groundwater flow estimated during site exploration and discussed in PNP FSAR Section 2.2.1, is 650 feet per year (0.074 feet/hour), which is not considered an aggressive flow rate. Groundwater elevation at the plant site is the same as Lake Michigan (elevation corresponds with lake water level).

Leaching of Calcium Hydroxide is readily noticeable as white deposits that remain on the concrete surface after a solution of water-free lime from the concrete and carbon dioxide from the air is absorbed and dries. The Containment ISI Program inspects concrete surfaces for signs of leaching.

No significant signs of leaching have been documented during these inspection walkdowns.

In summary, the accessible concrete will be inspected in accordance with ASME Section Subsection IWL requirements. Inaccessible concrete is not subject to flowing water, and was constructed consistent with ACI 201.2R such that below grade aging management is not required. Therefore, the conditions identified in the GALL Report, as revised by ISG-3, are satisfied, and aging management of increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide for below grade inaccessible concrete is not required.

(3) Increase in Porosity and Permeability, Cracking, Loss of Material Due to Aggressive Chemical Attack

Inaccessible Areas: ISG-3 indicates that a plant-specific aging management program is required for below-grade exterior reinforced concrete (basemat, embedded walls) if the environment is aggressive (pH < 5.5, chlorides > 500 ppm, or sulfates > 1500 ppm). Examination of representative samples of below-grade concrete, when excavated for any reason, is to be included as part of a plant-specific program. Periodic monitoring of below-grade water chemistry (including consideration of potential seasonal variations) is an acceptable approach to demonstrate that the below-grade environment is aggressive or non-aggressive.

Design and construction of PNP reinforced concrete provides for dense, well cured, and low permeability concrete that provides an acceptable degree of protection against exposure of below-grade exterior reinforced concrete to an aggressive environment. Cracking of concrete is controlled through proper arrangement and distribution of reinforcing bars. Continued or frequent cyclic exposure to the following aggressive environments is necessary for aggressive chemicals to cause a significant increase in porosity and permeability, cracking, loss of material (spalling, scaling):

Acidic solutions with pH < 5.5
Chloride solutions > 500 ppm
Sulfate solutions > 1500 ppm

Since aggressive chemicals are contained at plant sites, system leakage is possible that could cause the reinforced concrete to be exposed to chemicals beyond these limits. However, leaks are not expected to continue for the extensive periods required for degradation, and repairs would be completed prior to loss of intended function. It is not likely that leaks inside the structure would get outside to cause an aggressive chemical attack on embedded concrete.

An aggressive environment may also occur when reinforced concrete is exposed to aggressive aqueous solutions such as groundwater or aggressive water flow. PNP groundwater water sample measurements, summarized below, have confirmed that parameters are well below threshold limits that could cause concrete degradation i.e., (an aggressive environment does not exist).

PNP Groundwater Sampling results from 1966, 1996, and 2004:

Chemistry/Year	1966 (20 locations)	1996	2004
pH	Range 6.1 - 7.7 (> 5.5)	No reading	7.0
Chlorides - ppm	Range 4.0 - 39 (< 500)	23	139
Sulfates - ppm	Range 9.47 - 33.17 (< 1500)	15.2	11.5

Natural groundwater movement in this area is from the plant site to Lake Michigan. The rate of groundwater flow estimated during site exploration and discussed in FSAR Section 2.2.1 Groundwater, is 650 feet per year (0.074'/hour), which is not considered an aggressive flow rate. Groundwater elevation at the plant site is the same as Lake Michigan (elevation corresponds with lake water level).

Lake Michigan water samples, listed below also confirm that an aggressive environment does not exist.

Samples from 1962 to1966 of Lake Michigan water at or near the site and 1992 and 2004 site results:

Chemistry/Year	1962-1966	1992	2004
pH	Range 7.6 to 8.2 (> 5.5)	8.2	7.9
Chlorides - ppm	Range 5.0 to 32.0 (< 500)	11.5	12
Sulfates - ppm	Range 16.0 to 28.0 (< 1500)	29	24.4

In addition, PNP FSAR Chapter 2 - Table 2-12 - Analysis of Soil Samples shows that site soil pH of nine samples ranged between 8.1 and 8.5, indicating that soil around and under site structures is also alkaline and does not present an aggressive environment for inaccessible concrete.

In summary, PNP ground water sample measurements, taken over the course of many years and during varying seasons, confirm that parameters have remained consistent and are well below threshold limits that could cause concrete degradation (i.e., an aggressive environment does not exist). The rate of ground water flow is not considered an aggressive flow rate. Therefore, the conditions identified in the GALL Report, as revised by ISG-3, are satisfied; and aging management of increased porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack of below grade inaccessible concrete is not required.

In conclusion, additional groundwater monitoring over the period of license extension is not necessary. Sampling to date has shown no variance in over 40 years and the chemical parameters are well below limits considered aggressive. It would require a significant environmental event to substantially affect the quality of groundwater in the vicinity of PNP. A change in the environment due to a chemical release would be considered as an “abnormal event.” The SRP-LR states that aging effects from abnormal events need not be postulated specifically for license renewal.

(4) Expansion and Cracking Due to Reaction with Aggregates

Accessible Areas: In accordance with the GALL Report, as revised by ISG-3, accessible reinforced concrete structures and components will be monitored by the Containment Inservice Inspection Program to manage expansion and cracking due to reaction with aggregates.

Inaccessible Areas: The aggregate used in the concrete of the PNP components did not come from a region known to yield aggregates suspected of or known to cause aggregate reactions. Materials for concrete used in PNP structures and components were specifically investigated, tested and examined in accordance with pertinent ASTM standards. All aggregates used at PNP conform to the requirements of ASTM C33, “Standard Specification of Concrete Aggregates.” Appendix XI of ASTM C33 identifies methods for evaluating potential reactivity of aggregates including ASTM C295, ASTM C289, ASTM C227, and ASTM C342. PNP aggregates were tested to assure compliance with ASTM C-33 (FSAR 5.8.7.2): Petrographic Analysis - ASTM C-295, Potential Reactivity (Chemical) - ASTM C-289, and Potential Reactivity (Mortar Bar) - ASTM C-227. PNP aggregates were not tested to ASTM C-342, presumably because this method does not provide reliable results as noted in ACI 201.2R-77 Chapter 5, Section 5.3.3. Low alkali Portland Cement (ASTM C150 Type II) was used in the concrete mixes used in all PNP concrete structures, which mitigates harmful expansion due to alkali aggregate reaction.

Therefore, the conditions identified in the GALL Report, as revised by ISG-3, are satisfied and aging management of expansion and cracking due to reaction with aggregates for below grade inaccessible concrete is not required.

(5) Corrosion of Embedded Steel Due to Aggressive Groundwater Environment

Inaccessible Areas: For the aging effects of cracking, loss of bond, loss of material (spalling, scaling) due to corrosion of embedded steel for concrete components, ISG-3 indicates that a plant-specific aging management program is required if the below-grade environment is aggressive (pH < 5.5, chlorides > 500 ppm, or sulfates > 1500 ppm). Examination of representative samples of below-grade concrete, when excavated for any reason, is to be included as part of a plant-specific program. Note: Periodic monitoring of below-grade water chemistry (including consideration of potential seasonal variations) is an acceptable approach to demonstrate that the below-grade environment is aggressive or non-aggressive.

The groundwater environment that exists at PNP has been reviewed in detail in the discussion for Aggressive Chemical Attack above, and will not be repeated here.

PNP groundwater water sample measurements, taken over the course of many years and during varying seasons, confirm that parameters have remained consistent and are well below threshold limits that could cause concrete degradation or corrosion of embedded steel (i.e., an aggressive environment does not exist). The rate of groundwater flow is not considered an aggressive flow rate. The conditions identified in the GALL Report, as revised by ISG-3, are satisfied; therefore, aging management of cracking, loss of bond, loss of material (spalling, scaling) due to corrosion of embedded steel for below grade inaccessible concrete is not required.

> In conclusion, additional groundwater monitoring over the period of license extension is not necessary. Sampling to date has shown no variance in over 40 years and the chemical parameters are well below limits considered aggressive. It would require a significant environmental event to substantially affect the quality of groundwater in the vicinity of PNP. A change in the environment due to a chemical release would be considered as an "abnormal event." The SRP-LR states that aging effects from abnormal events need not be postulated specifically for license renewal.

During the audit and review, the project team noted that the applicant's Structural Monitoring Program AMP does not discuss the need or lack of need to perform periodic ground water monitoring to ensure that the below -grade water chemistry does not become aggressive in the future. The applicant was asked to justify not performing periodic ground water monitoring during the CLB and potential extended license period to check water chemistry for non-aggressiveness.

In a letter dated September 2, 2005, the applicant states that as discussed in PNP LRA Section 3.5.2.2.1.1, ground water chemistry records are available for the current operating period, and provide the basis that water in contact with PNP's below-grade concrete is currently non-aggressive, and has been non-aggressive over at least the last 40 years. To ensure ground water remains non-aggressive over the extended operating period, ground water sampling for pH, chlorides, and sulfates will be performed as part of the Structural Monitoring Program with a periodicity not to exceed every 5 years. Accordingly, changes are made to PNP AMP B2.1.19, Structural Monitoring Program.[*]

In addition to the above, conforming changes from the September 2, 2005 letter are made in various locations of PNP LRA Section 3.5.2.2 which state that continued groundwater sampling is unnecessary. The new paragraph to be added which replaces the existing paragraph reads as follows: "As part of the Structural Monitoring Program, Palisades will continue to monitor groundwater on a periodic basis to ensure it remains non-aggressive, such that the associated aging effects remain not applicable."

The new paragraph is added to the following PNP LRA locations, to replace the existing paragraphs, as follows:

> On Page 3-271, replace existing paragraph that begins, "In addition it is concluded that additional groundwater monitoring ..."
>
> On Page 3-273, replace existing paragraph that begins, "In addition it is concluded that additional groundwater monitoring ..."

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

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[*]Reference Section 2.16 of this audit and review report for the evaluation of the specific changes to the PNP AMP.

On the basis of its audit and review, the project team finds that loss of material and cracking of accessible containment concrete due to freeze-thaw; increase in porosity, permeability, and loss of strength of accessible containment concrete due to leaching of calcium hydroxide; increase in porosity and permeability, cracking, loss of material of accessible containment concrete due to aggressive chemical attack; expansion and cracking of accessible containment concrete due to reaction with aggregates; and cracking, loss of bond, loss of material of accessible containment concrete due to corrosion of embedded steel will be adequately managed by the PNP containment inservice inspection program in accordance with ISG-3. During the audit and review, the project team interviewed members of the applicant's technical staff and reviewed relevant operating experience to confirm that these aging effects due to these aging mechanisms have not been observed or observed and corrective action taken.

In addition, the project team finds that loss of material and cracking of inaccessible containment concrete due to freeze-thaw; increase in porosity, permeability, and loss of strength of inaccessible containment concrete due to leaching of calcium hydroxide; increase in porosity and permeability, cracking, loss of material of inaccessible containment concrete due to aggressive chemical attack; expansion and cracking of inaccessible containment concrete due to reaction with aggregates; and cracking, loss of bond, loss of material of inaccessible containment concrete due to corrosion of embedded steel are not plausible aging effects due to the nonexistence of these aging mechanisms in accordance with ISG-3. Through interviews with the applicant's technical staff and review of applicable documentation, the project team finds that the PNP concrete containment is designed in accordance with ACI 318-63 and constructed of concrete using ingredients conforming to ACI and ASTM standards in accordance with ISG-3. In addition, ground water sample testing and ground water flow rate monitoring have demonstrated that an aggressive environment does not exist at PNP for inaccessible concrete. The applicant has demonstrated that aggregates used for containment concrete do not cause aggregate reactions. The project team finds that the requirements of ISG-3 have been satisfied and a plant-specific aging management program for inaccessible containment concrete is not required.

The project team finds that, based on the program identified above for accessible containment concrete, and demonstration that specific criteria of ISG-3 has been satisfied for not requiring a plant-specific AMP for inaccessible containment concrete, the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.1 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.1.2 Cracking, Distortion, and Increase in Component Stress Level Due to Settlement; Reduction of Foundation Strength Due to Erosion of Porous Concrete Subfoundations, If Not Covered by Structures Monitoring Program (PNP LRA Section 3.5.2.2.1.2)

The project team reviewed PNP 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 that cracking, distortion, and increase in component stress level due to settlement could occur in concrete and steel containments. Also, reduction of foundation strength due to erosion of porous concrete subfoundations could occur in all types of containments. Some plants may rely on a de-watering system to lower the site ground water level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's Structures Monitoring Program.

In PNP LRA Section 3.5.2.2.1.2, the applicant addresses cracks, distortion, and increases in concrete foundation stress level due to settlement. Also in this PNP LRA section, the applicant addresses reduction of foundation strength due to erosion of porous concrete subfoundations. The following indented paragraphs are extracted from the PNP LRA. **The project team's evaluation is provided at the end of the indented paragraphs**. In the PNP LRA, the applicant states the following:

> (1) Cracks; Distortion; Increase in Component Stress Level Due to Settlement
>
> Concrete structures can be affected by differential settlement between supporting foundations, within the building, or between buildings. For buildings experiencing significant settlement, cracks on structural members may be visibly detected. Cracks, distortion, and an increase in component stress level due to settlement are not considered as aging effects requiring management for the PNP primary containment structure since it is founded on highly dense, compacted sand, that remained after removal of the sand dunes for site preparation (FSAR Section 2.3.4, Engineering Geology). The PNP primary containment structure did not require a de-watering system to control settlement, since subsurface conditions of dense compact sand and compacted backfill do not require such a system.
>
> For concrete structures founded on dense soil or backfill, if in the past 20 years of experience for a structure, the total differential settlement experienced are well within the permissible limits for this type of structure and no settlement has manifested itself via cracked walls or cracked foundations, then it can be concluded that cracking due to settlement is not significant, and would not be applicable for the structure during the period of extended operation. No settlement monitoring program for PNP structures has been formally implemented. In support of NUREG 0820, Integrated Plant Safety Assessment, Systematic Evaluation Program, Palisades Plant,…Final Report October 1982, the NRC evaluation for topics II-4.D, Stability of Slopes and II-4.F, Settlement of Foundations and Buried Equipment, provided NRC staff conclusions on the site conditions. On the settlement issue, the NRC concluded that, "the settlement of foundations and buried equipment will not be a safety problem of concern."
>
> (2) Reduction in Foundation Strength, Cracking, Differential Settlement Due to Erosion of Porous Concrete Subfoundation
>
> The PNP primary containment base mat rests directly on native soil (dense fine sand). There is no porous concrete subfoundation below the base mat. Therefore, erosion of porous subfoundation cement by ground water, a matter addressed in Section II A1 of the GALL Report, is not an issue at the PNP plant. PNP does not have a porous concrete foundation and has no subsurface

drainage system, as was identified at other facilities in NRC Information Notice 97-11. In addition, natural groundwater movement in this area is from the plant site to Lake Michigan. The rate of groundwater flow estimated during site exploration and discussed in FSAR Section 2.2.1, is 650 feet per year (0.074'/hour), which is not considered an aggressive flow rate.

On the basis of its audit and review, the project team finds that cracking, distortion, and increase in component stress level due to containment settlement and reduction of containment foundation strength due to erosion of porous concrete subfoundations are not plausible aging effects due to the nonexistence of these aging mechanisms. The applicant states that the aging effects due to settlement are not expected at PNP for the containment structure since it is founded on highly dense, compacted sand, that remained after removal of the sand dunes for site preparation. In addition, there is no porous concrete subfoundation below the containment base mat. The project team agrees with the applicant that an AMP is not required since these aging mechanisms do not occur at PNP. However, the applicant has conservatively elected to use the Structural Monitoring Program to monitor the above grade exposed containment concrete for the aging effect of cracking due to settlement, which the project team finds acceptable.

The project team finds that, based on the conservative application of the program identified above for accessible containment concrete, and demonstration that settlement and a porous concrete subfoundation do not occur and exist, respectively, for the PNP containment, the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.2 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.1.3 Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature (PNP LRA Section 3.5.2.2.1.3)

The project team reviewed PNP 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 reduction of strength and modulus of elasticity due to elevated temperatures could occur in PWR concrete and steel containments. The GALL Report calls for a plant-specific aging management program and recommends further evaluation if any portion of the concrete containment components exceed specified temperature limits, i.e., general area temperature 66°C (150°F) and local area temperature 93°C (200°F).

The applicant states, in the PNP LRA, that for the containment concrete foundation, dome and exterior wall, this aging effect is not applicable to PNP. In PNP LRA Section 3.5.2.2.1.3, the applicant states that during normal operation, all areas within the containment building do not experience elevated temperatures greater than 150°F general and greater than 200°F local. Therefore, change in material properties (reduction of strength and modulus of concrete) due to elevated temperature is not an aging effect requiring management for the PNP containment concrete. The project team determined through discussions with the applicant’s technical staff that operating experience indicates that the containment concrete has never experienced any aging effects due to elevated temperatures.

On the basis that PNP does not have a containment concrete elevated temperature aging mechanism, the project team finds that this aging effect and aging mechanism is not applicable to PNP.

3.5.2.1.4 Loss of Material Due to Corrosion in Inaccessible Areas of Steel Containment Shell or Liner Plate (PNP LRA Section 3.5.2.2.1.4)

The project team reviewed PNP 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 loss of material due to corrosion could occur in inaccessible areas of the steel containment shell or the steel liner plate for all types of containments. The GALL Report recommends further evaluation of plant-specific programs to manage this aging effect for inaccessible areas if specific criteria defined in the GALL Report cannot be satisfied.

In PNP LRA Section 3.5.2.2.1.4, the applicant addresses loss of material of the steel liner plate due to corrosion in inaccessible areas. The PNP LRA states that GALL Report Item IIA1.2-a, states that loss of material due to corrosion is not significant if four conditions are satisfied. Each condition, and a PNP discussion for that condition, is itemized below. The following indented paragraphs are extracted from the PNP LRA. The PNP LRA states as follows:

> (1) Concrete meeting the requirements of ACI 318 or 349 and the guidance of 201.2R was used for the containment concrete in contact with the embedded containment shell or liner.
>
> The PNP containment structure was designed and constructed in accordance with ACI-318-63, ACI-301-72 (proposed) and the ASME Pressure Vessel Code, Sections III, VIII and IX, 1965 (reference PNP FSAR Section 5.1.6.2). PNP's concrete, meeting the requirements of ACI 318 (and is consistent with the guidance of 201.2R-77), was used for the containment concrete in contact with the embedded containment shell or liner, as discussed in PNP FSAR Section 5.8.2 and Section 5.8.7.1. These materials produced an excellent high strength, dense, sound concrete.
>
> (2) The concrete is monitored to ensure that it is free of penetrating cracks that provide a path for water seepage to the surface of the containment shell or liner.
>
> The containment exterior concrete is monitored by the PNP Containment Inservice Inspection Program to ensure that it is free of penetrating cracks that might provide a path for water seepage to the surface of the containment shell or liner. The containment interior 18" reinforced concrete floor placed over the containment bottom steel liner is monitored by the PNP Structural Monitoring Program to ensure that penetrating cracks are not occurring.

(3) The moisture barrier, at the junction where the shell or liner becomes embedded, is subject to aging management activities in accordance with IWE requirements.

The moisture barrier, at the junction where the shell or liner becomes embedded, is subject to aging management activities in accordance with PNP Containment Inservice Inspection Program requirements.

(4) Borated water spills and water ponding on the containment concrete floor are not common and when detected are cleaned up in a timely manner.

Borated water spills and water ponding on the containment concrete floor are not common, and when detected, are cleaned up in a timely manner, in accordance with the PNP Boric Acid Corrosion Program.

The applicant states, in the PNP LRA, that based on satisfying the above four conditions, corrosion is not significant for inaccessible areas of the containment liner.

On the basis of its audit and review, the project team finds that all of the criteria identified in the GALL Report are satisfied. In the PNP LRA, the applicant states that the containment concrete in contact with the steel liner plate is designed in accordance with ACI 318-63, and meets the requirements of guideline ACI 201.2R-77. Accessible concrete of the containment structure is monitored for penetrating cracks under the PNP AMP Containment Inservice Inspection Program. In addition, the applicant states that the accessible portions of the steel liner plate and moisture barrier where the liner becomes embedded are inspected in accordance with the same PNP program. Spills (e.g., borated water spill) are cleaned up in a timely manner in accordance with the applicant's Boric Acid Corrosion Program. Operating experience demonstrates that the aging effect of loss of material due to corrosion has not been significant for the PNP liner plate. The project team finds that no additional plant-specific aging management program is required to manage inaccessible areas of the containment steel liner plate.

The project team finds that, based on the programs identified above and the satisfaction of specific GALL Report criteria, the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.4 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.1.5 <u>Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature (PNP LRA Section 3.5.2.2.1.5)</u>

PNP LRA Section 3.5.2.2.1.5 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 TLAA is reviewed by the NRR DE staff. The evaluation of this TLAA will be addressed separately in Section 4 of the SER related to the PNP LRA.

3.5.2.1.6 Cumulative Fatigue Damage (PNP LRA Section 3.5.2.2.1.6)

PNP LRA Section 3.5.2.2.1.6 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 TLAA is reviewed by the NRR DE staff. The evaluation of this TLAA will be addressed separately in Section 4 of the SER related to the PNP LRA.

3.5.2.1.7 Cracking Due to Cyclic Loading and SCC (PNP LRA Section 3.5.2.2.1.7)

The project team reviewed PNP 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 of containment penetrations (including penetration sleeves, penetration bellows, and dissimilar metal welds) due to cyclic loading or SCC could occur in all types of PWR and BWR containments. Cracking could also occur in vent line bellows, vent headers and downcomers due to SCC for BWR containments. A visual VT-3 examination would not detect such cracks. The GALL Report recommends further evaluation of the inspection methods implemented to detect these aging effects.

The applicant states, in the PNP LRA, that for penetration sleeves, bellows, and dissimilar metal welds, this aging effect is not applicable to PNP. In PNP LRA Section 3.5.2.2.1.7, the applicant addresses cracking in penetration sleeves, bellows, and dissimilar metal welds due to cyclic loading, or crack initiation and growth in penetration sleeves, bellows, and dissimilar metal welds due to SCC. The PNP LRA states that no expansion bellows are required in the PNP containment design. All piping and ventilation penetrations are of the rigid welded type and are solidly anchored to the containment shell, thus precluding any requirement for expansion bellows (Reference PNP FSAR Section 5.8.6.2.2). Stress concentrations around openings in the liner plate were calculated using the theory of elasticity. These stress concentrations were then reduced by thickening the liner plate around each penetration in accordance with the ASME B&PV Code, Section III, 1965.

The applicant also states, in the PNP LRA, that anchor bolts are provided as part of each penetration assembly. When the penetration assembly has no significant external loads, the anchors maintain the strain compatibility between the liner plate and the concrete. When significant loads are present, the anchors control the inward displacement of the liner plate. The stress level in the anchor bolts from external loads is in accordance with the AISC Code (Reference PNP FSAR Section 5.8.6.4.1).

Therefore, the applicant states in the PNP LRA, that no further evaluation is required since these GALL Report items are not applicable to the PNP design.

The project team finds through discussions with the applicant’s technical staff, review of PNP LRA Sections 4.6.1 and 4.6.2, and the evaluation above that due to PNP’s low stress design configuration and low number of cycles, fatigue is not an applicable aging effect for PNP containment penetrations and further evaluation of inspection methods to detect fatigue related aging effects is not required. On the basis that PNP does not have a severe cyclic loading and SSC containment penetration aging mechanism, the project team finds that this aging effect (cracking) is not applicable to PNP.

3.5.2.2 Class 1 Structures (PNP LRA Section 3.5.2.2.2)

The project team reviewed PNP LRA Section 3.5.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2, which addresses several areas discussed below.

3.5.2.2.1 Aging of Structures Not Covered by Structures Monitoring Program (PNP LRA Section 3.5.2.2.2.1)

The project team reviewed PNP 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) scaling, cracking, and spalling due to repeated freeze-thaw for Groups 1-3, 5, 7-9 structures; (2) scaling, cracking, spalling and increase in porosity and permeability due to leaching of calcium hydroxide and aggressive chemical attack for Groups 1-5, 7-9 structures; (3) expansion and cracking due to reaction with aggregates for Groups 1-5, 7-9 structures; (4) cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel for Groups 1-5, 7-9 structures; (5) cracks, distortion, and increase in component stress level due to settlement for Groups 1-3, 5, 7-9 structures; (6) reduction of foundation strength due to erosion of porous concrete subfoundation for Groups 1-3, 5-9 structures; (7) loss of material due to corrosion of structural steel components for Groups 1-5, 7-8 structures; (8) loss of strength and modulus of concrete structures due to elevated temperatures for Groups 1-5; and (9) crack initiation and growth due to SCC and loss of material due to crevice corrosion of stainless steel liner for Groups 7 and 8 structures. Further evaluation is necessary only for structure/aging effect combinations not covered by the Structures Monitoring Program.

Technical details of the aging management issue are presented in SRP-LR Subsection 3.5.2.2.1.2 for items (5) and (6) and SRP-LR Subsection 3.5.2.2.1.3 for item (8), above.

In PNP LRA Section 3.5.2.2.2.1, the applicant addresses all types of aging effects for all groups (except Group 6) of accessible interior/exterior concrete and steel components. The following indented paragraphs are extracted from the PNP LRA. **The project team's evaluation is provided at the end of the indented paragraphs.** In the PNP LRA, the applicant states the following:

> (1) Loss of Material (Spalling, Scaling) and Cracking Due to Freeze-Thaw
>
> Accessible Areas: In accordance with the GALL Report, as clarified by ISG-3, accessible reinforced concrete structures and components will be monitored by the PNP Structural Monitoring Program to manage loss of material (spalling, scaling) and cracking due to freeze-thaw.
>
> Inaccessible Areas: PNP is located in an area with severe weathering conditions as noted on Figure 1 of ASTM C33-99. Freeze-thaw is not considered an aging mechanism for concrete components below the frost line (depth of 42 inches in accordance with Michigan Building Code).

The PNP concrete structures and concrete are designed in accordance with ACI 318-63 and -71, and constructed using ingredients conforming to ACI and ASTM standards. PNP specifications require all concrete to contain an air-entraining agent in sufficient quantity to maintain specified percentages based on nominal maximum size aggregate. For severe weather exposures, the air content identified varies from three to five percent. Water/cement ratios, for concrete mixes, range from 0.45 to 0.46 for the 4000 psi concrete used in the primary containment internal concrete construction, and in other PNP structures. Water/cement ratio for 3000 psi concrete used in the original auxiliary building and other original structures as previously identified, is 0.47, slightly above the recommended range.

Review of Operating Experience and Maintenance Rule Structures Monitoring results provide confirmation that freeze-thaw degradation of PNP concrete has not occurred.

As described in NUREG-1557, “Summary of Technical Information and Agreements from Nuclear Management and Resources Council [NUMARC] Industry Reports Addressing License Renewal,” freeze-thaw does not cause loss of material from reinforced concrete in foundations, and in above and below grade exterior concrete, for plants located in a geographic region of negligible weathering conditions (weathering index <100 day-inch/year). Similarly, freeze-thaw damage is not significant for reinforced concrete in foundations, and in above and below grade exterior concrete, for plants located in areas in which weathering conditions are considered severe (weathering index >500 day-inch/year) or moderate (100-500 day-inch/year), provided that the concrete mix design meets the air content (entrained air 3-6%) and water-to-cement ratio (0.35-0.45) specified in ACI 318-63 or ACI 349-85. PNP water-cement ratios range between 0.45 and 0.47 and ACI 201.2R-77 (Reference 7.22) Section 1.4.2 recommends a not to exceed water-cement ratio of 0.50 for other than “thin” structures. In addition, at PNP, the ground tends to freeze and stay frozen through the winter, which means that below grade concrete only is exposed, essentially, to one freeze-thaw cycle in a typical year. Since damage to concrete from freeze-thaw is related to repeated cycles of freeze-thaw as noted from industry guidance, and no evidence of freeze-thaw damage has been identified in exposed concrete which is subjected to repeated cycles, it is concluded that below grade concrete will not experience damage or degradation.

Therefore, since these conditions for PNP concrete are essentially satisfied, aging management is not required for below grade concrete.

On the basis of its audit and review, the project team finds that loss of material (spalling and scalling) and cracking of accessible concrete due to freeze-thaw for Groups 1-3, 5, and 7-9 structures; will be adequately managed by the PNP structural monitoring program as clarified by ISG-3. During the audit and review, the project team interviewed members of the applicant’s technical staff and reviewed relevant operating experience to confirm that these aging effects due to this aging mechanism have not been observed or when observed corrective action taken.

In addition, the project team finds that loss of material and cracking of inaccessible concrete for Groups 1-3, 5, and 7-9 structures are not plausible aging effects due to the nonexistence of this aging mechanism. The applicant states that PNP Class 1 structures are designed in accordance with ACI 318-63, which results in adequate air entrainment to prevent cracking from freeze-thaw. The applicant states that concrete for PNP Class 1 structures also meets the guidelines of ACI 201.2R-77 for low water to cement ratio, resulting in a dense concrete mix and more resistant to water intrusion. Through interviews with the applicant's technical staff and review of applicable documentation, the project team finds that the concrete of PNP Class 1 structures is designed in accordance with ACI 318-63 and constructed of concrete using ingredients conforming to ACI and ASTM standards. The project team finds that the recommendations of the GALL Report have been satisfied and a plant-specific aging management program for inaccessible concrete of Class 1 structures is not required for this aging effect.

The following indented paragraphs are extracted from the PNP LRA. **The project team's evaluation is provided at the end of the indented paragraphs**. In the PNP LRA, the applicant states the following:

> (2) Increase in Porosity, Permeability, and Loss of Strength Due to Leaching
>
> Accessible Areas: In accordance with the GALL Report, as clarified by ISG-3, accessible reinforced concrete structures and components will be monitored by the PNP Structural Monitoring Program to manage increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide.
>
> Inaccessible Areas: The PNP concrete structures and concrete components are designed in accordance with ACI 318-63 and constructed using ingredients conforming to ACI and ASTM standards, which provide for a good quality, dense, well cured, and low permeability concrete. Cracking is controlled through proper arrangement and distribution of reinforcing bars.
>
> Concrete structures and concrete components are constructed of a dense, well-cured concrete with an amount of cement suitable for strength development, and achievement of a water-to-cement ratio (PNP water/cement ratio 0.45), which is characteristic of concrete having low permeability. This is consistent with the recommendations and guidance provided by ACI 201.2R-77.
>
> In addition, concrete components must be exposed to flowing water through the concrete component for this to be a significant issue. Natural groundwater movement in this area is from the plant site to Lake Michigan. The rate of groundwater flow estimated during site exploration and shown in the FSAR, is 650 feet per year (0.074 feet/hour), which is not considered an aggressive flow rate. Groundwater elevation at the plant site is the same as Lake Michigan (elevation corresponds with lake water level).
>
> Leaching of Calcium Hydroxide is readily noticeable as white deposits that remain on the concrete surface after a solution of water-free lime from the concrete and carbon dioxide from the air is absorbed and dries. The PNP Structural Monitoring Program inspects concrete surfaces for signs of leaching.

No significant signs of leaching have been documented during these inspection walkdowns.

Therefore, the conditions identified in the GALL Report, as revised by ISG-3 are satisfied and aging management of increase in porosity and permeability, loss of strength due to leaching of calcium hydroxide for below grade inaccessible concrete is not required.

On the basis of its audit and review, the project team finds that increase in porosity, permeability, and loss of strength due to leaching of calcium hydroxide of accessible concrete for Groups 1-5 and 7-9 structures; will be adequately managed by the applicant's Structural Monitoring Program. During the audit and review, the project team interviewed members of the applicant's technical staff and reviewed relevant operating experience to confirm that these aging effects due to this mechanism have not been observed or when observed corrective action taken.

In addition, the project team finds that increase in porosity, permeability, and loss of strength due to leaching of calcium hydroxide of inaccessible concrete for Groups 1-5 and 7-9 structures; are not plausible aging effects due to the nonexistence of this aging mechanism. The applicant states that PNP Class 1 structures are designed in accordance with ACI 318-63 and meet the requirements of ACI 201.2R-77, which results in good quality, dense, well cured, and low permeability concrete which does not leach. In addition, the applicant states that the rate of groundwater flow is 650 feet per year, which is not an aggressive rate. The project team finds that the recommendations of the GALL Report have been satisfied and a plant-specific aging management program for inaccessible concrete of Class 1 structures is not required for this aging effect.

The following indented paragraphs are extracted from the PNP LRA. **<u>The project team's evaluation is provided at the end of the indented paragraphs</u>.** In the PNP LRA, the applicant states the following:

(2a) Increase in Porosity and Permeability, Cracking, Loss of Material (spalling, scaling) Due to Aggressive Chemical Attack

Accessible Areas: In accordance with the GALL Report, as revised by ISG-3, accessible reinforced concrete structures and components will be monitored by the Structures Monitoring Program to manage increase in porosity and permeability, cracking, loss of material (spalling, scaling) due to aggressive chemical attack.

Inaccessible Areas: A plant-specific aging management program is required for below-grade exterior reinforced concrete (basemat, embedded walls) if the environment is aggressive (pH < 5.5, chlorides > 500 ppm, or sulfates > 1500 ppm). Examination of representative samples of below-grade concrete, when excavated for any reason, is to be included as part of a plant-specific program.

Note: Periodic monitoring of below-grade water chemistry (including consideration of potential seasonal variations) is an acceptable approach to demonstrate that the below-grade environment is aggressive or non-aggressive.

At PNP, design and construction of reinforced concrete provides for dense, well cured, and low permeability concrete that provides acceptable degree of protection against exposure of below grade exterior reinforced concrete to an aggressive environment. Cracking of concrete is controlled through proper arrangement and distribution of reinforcing bars. Continued or frequent cyclic exposure to the following aggressive environments is necessary for aggressive chemicals to cause a significant increase in porosity and permeability, cracking, loss of material (spalling, scaling):

Acidic solutions with pH < 5.5
Chloride solutions > 500 ppm
Sulfate solutions > 1500 ppm

Since aggressive chemicals are contained at plant sites, system leakage is possible that could cause the embedded steel to be exposed to chemicals beyond these limits. However, leaks are not expected to continue for the extensive periods required for degradation, and repairs would be completed prior to loss of intended function. It is not likely that leaks inside the structure would get outside to cause an aggressive chemical attack on embedded concrete.

An aggressive environment may also occur where embedded steel is exposed to aggressive aqueous solutions such as groundwater or aggressive water flow. PNP groundwater water sample measurements, summarized below, have confirmed that parameters are well below threshold limits that could cause concrete degradation or corrosion of embedded steel (i.e., an aggressive environment does not exist).

PNP Groundwater Sampling from 1966 (18 Sampling Locations results), 1996 South Monitoring Well, and 2004 Well #14 at PNP:

Chemistry/Year	1966 (18 locations)	1996	2004
pH	Range 6.1-7.7 (> 5.5)	No reading	7.0
Chlorides - ppm	Range 4.0-39 (<500)	23	139
Sulfates - ppm	Range 9.47-33.17 (<1500)	15.2	11.5

Natural groundwater movement in this area is from the plant site to Lake Michigan. The rate of groundwater flow estimated during site exploration and described in FSAR Section 2.2.1 Groundwater, is 650 feet per year (0.074 feet/hour), which is not considered an aggressive flow rate.

Groundwater elevation at the plant site is the same as Lake Michigan (elevation corresponds with lake water level).

Lake Michigan water samples also confirm an aggressive environment does not exist.

Samples from 1962 to1966 of Lake Michigan water at or near the site and 1992 and 2004 site results:

Chemistry/Year	1962-1966	1992	2004
pH	Range 7.6 - 8.2 (>5.5)	8.2	7.9
Chlorides - ppm	Range 5.0 - 32.0 (<500)	11.5	12
Sulfates - ppm	Range 20.0 to 28.0 (<1500)	29	24.4

In addition, PNP FSAR Chapter 2 - Table 2-12 - Analysis of Soil Samples shows that site soil pH of nine samples ranged between 8.1 and 8.5, indicating that soil around and under site structures is also alkaline and does not present an aggressive environment for inaccessible concrete.

In summary, PNP groundwater water sample measurements have confirmed that parameters are well below threshold limits that could cause concrete degradation (i.e., an aggressive environment does not exist). The rate of groundwater flow is not considered an aggressive flow rate. The conditions identified in the GALL Report, as revised by ISG-3 are satisfied; therefore, aging management of increased porosity and permeability, cracking, and loss of material (spalling, scaling) due to aggressive chemical attack of below grade inaccessible concrete is not required.

It is also concluded that it is not necessary to monitor groundwater chemistry over the period of license extension, since it is not credible to postulate that some environmental event will occur in the future that would affect the quality of groundwater in the vicinity of PNP. A change in the environment due to a chemical release would be considered as an “abnormal event.” The SRP-LR states that aging effects from abnormal events need not be postulated specifically for license renewal.

During the audit and review, the project team noted that the applicant’s Structural Monitoring Program AMP does not discuss the need or lack of need to perform periodic ground water monitoring to ensure that the below -grade water chemistry does not become aggressive in the future. The applicant was asked to justify not performing periodic ground water monitoring during the CLB and potential extended license period to check water chemistry for non-aggressiveness.

In a letter dated September 2, 2005, the applicant states that as discussed in PNP LRA Section 3.5.2.2.1.1, ground water chemistry records are available for the current operating period, and provide the basis that water in contact with Palisades' below-grade concrete is currently non-aggressive, and has been non-aggressive over at least the last 40 years. To ensure ground water remains non-aggressive over the extended operating period, ground water sampling for pH, chlorides, and sulfates will be performed as part of the Structural Monitoring Program with a periodicity not to exceed every 5 years. Accordingly, changes are made to PNP AMP B2.1.19, Structural Monitoring Program.*

In addition to the above, conforming changes are made in various locations of PNP LRA Section 3.5.2.2 which states that continued groundwater sampling is unnecessary. The new paragraph to be added which replaces the existing paragraph reads as follows: "As part of the Structural Monitoring Program, Palisades will continue to monitor groundwater on a periodic basis to ensure it remains non-aggressive, such that the associated aging effects remain not applicable."

The new paragraph is added to the following PNP LRA location, to replace the existing paragraph, as follows:

> On Page 3-286, replace existing paragraph that begins, "It is also concluded that it is not necessary to monitor groundwater chemistry ..."

On the basis of its audit and review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

On the basis of its audit and review, the project team finds that increase in porosity, permeability, cracking and loss of material due to aggressive chemical attack of accessible concrete of Groups 1-5 and 7-9 structures; will be adequately managed by the PNP structural monitoring program. During the audit and review, the project team interviewed members of the applicant's technical staff and reviewed relevant operating experience to confirm that these aging effects due to this mechanism have not been observed or when observed corrective action taken.

In addition, the project team finds that increase in porosity, permeability, cracking and loss of material due to aggressive chemical attack of inaccessible concrete of Groups 1-5 and 7-9 structures; are not plausible aging effects due to the nonexistence of this aging mechanism. The applicant states that PNP Class 1 structures are designed in accordance with ACI 318-63 and meet the requirements of ACI 201.2R-77, which results in good quality, dense, well cured, and low permeability concrete which provides an acceptable degree of protection against an aggressive environment. In addition, the applicant states that the rate of groundwater flow is 650 feet per year, which is not an aggressive rate. The project team finds that the

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*Reference Section 2.16 of this audit and review report for the evaluation of the specific changes to the PNP AMP.

recommendations of the GALL Report have been satisfied and a plant-specific aging management program for inaccessible concrete of Class 1 structures is not required for this aging effect.

The following indented paragraphs are extracted from the PNP LRA. **The project team's evaluation is provided at the end of the indented paragraphs**. In the PNP LRA, the applicant states the following:

> (3) Expansion and Cracking Due to Reaction with Aggregates
>
> Accessible Areas: In accordance with the GALL Report, as clarified by ISG-3, accessible reinforced concrete structures and components will be monitored by the Structural Monitoring Program to manage expansion and cracking due to reaction with aggregates.
>
> Inaccessible Areas: The aggregate used in the concrete of the PNP components did not come from a region known to yield aggregates suspected of or known to cause aggregate reactions. Materials for concrete used in PNP structures and components were specifically investigated, tested and examined in accordance with pertinent ASTM standards. All aggregates used at PNP conform to the requirements of ASTM C33, "Standard Specification of Concrete Aggregates." Appendix XI of ASTM C33 identifies methods for evaluating potential reactivity of aggregates including ASTM C295, ASTM C289, ASTM C227, and ASTM C342. Low alkali Portland Cement (ASTM C150 Type II) was used in the concrete mixes used in all PNP concrete structures, which mitigates harmful expansion due to alkali aggregate reaction (PNP FSAR Section 5.8.2).
>
> Therefore, the conditions identified in the GALL Report, as revised by ISG-3, are satisfied and aging management of expansion and cracking due to reaction with aggregates for below grade inaccessible concrete is not required.

On the basis of its audit and review, the project team finds that expansion and cracking due to reaction with aggregates of accessible concrete of Groups 1-5 and 7-9 structures; will be adequately managed by the PNP structural monitoring program. During the audit and review, the project team interviewed members of the applicant's technical staff and reviewed relevant operating experience to confirm that these aging effects due to this mechanism have not been observed or when observed corrective action taken.

In addition, the project team finds that expansion and cracking due to reaction with aggregates of inaccessible concrete of Groups 1-5 and 7-9 structures; are not plausible aging effects due to the nonexistence of this aging mechanism. The applicant states that the aggregates used in the concrete of PNP Class 1 structures were specifically investigated, tested and examined in accordance with ASTM C33, "Standard Specification of Concrete Aggregates," which resulted in the use of materials not susceptible to aggregate reactions. In addition, low alkali cement was used in the concrete mix, which mitigates expansion. The project team finds that the recommendations of the GALL Report have been satisfied and a plant-specific aging management program for inaccessible concrete of Class 1 structures is not required for this aging effect.

The following indented paragraphs are extracted from the PNP LRA. **<u>The project team's evaluation is provided at the end of the indented paragraphs</u>**. In the PNP LRA, the applicant states the following:

> (4) Cracking, Spalling, Loss of Bond, and Loss of Material Due to Corrosion of Embedded Steel
>
> Accessible Areas: In accordance with the GALL Report, as revised by ISG-3, accessible reinforced concrete structures and components will be monitored by the Structures Monitoring Program to manage cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel.
>
> Inaccessible Areas: A plant-specific aging management program is required if the below-grade environment is aggressive (pH < 5.5, chlorides > 500 ppm, or sulfates > 1500 ppm). Examination of representative samples of below-grade concrete, when excavated for any reason, is to be included as part of a plant-specific program. Note: Periodic monitoring of below-grade water chemistry (including consideration of potential seasonal variations) is an acceptable approach to demonstrate that the below-grade environment is aggressive or non-aggressive.
>
> At PNP, design and construction of reinforced concrete provides for dense, well cured, and low permeability concrete that provides an acceptable degree of protection against exposure of the embedded steel (including, but not limited to, reinforcing steel, unistrut, nelson studs, anchorages consisting of steel shapes/plate, tendon sheaths, conduit, and steel pipes/drains), to an aggressive environment. Cracking of concrete is controlled through proper arrangement and distribution of reinforcing bars. Continued or frequent cyclic exposure to the following aggressive environments is necessary for aggressive chemicals to cause significant corrosion of embedded steel:
>
> Acidic solutions with pH < 5.5
> Chloride solutions > 500 ppm
> Sulfate solutions > 1500 ppm
>
> Since aggressive chemicals are contained at plant sites, system leakage is possible that could cause the embedded steel to be exposed to chemicals beyond these limits. However, leaks are not expected to continue for the extensive periods required for degradation, and repairs would be completed prior to loss of intended function.
>
> An aggressive environment may also occur where embedded steel is exposed to aggressive aqueous solutions such as groundwater or aggressive water flow. PNP groundwater water sample measurements have confirmed that parameters are well below threshold limits that could cause concrete degradation or corrosion of embedded steel (an aggressive environment does not exist).
>
> PNP Groundwater Sampling from 1966 (18 Sampling Locations results), 1996 South Monitoring Well, and 2004 Well #14 at PNP:

Chemistry/Year	1966	1996	2004
pH	Range 6.1-7.7 (> 5.5)	No reading	7.0
Chlorides - ppm	Range 4.0-39 (<500)	23	139
Sulfates - ppm	Range 9.47-33.17 (<1500)	15.2	11.5

Natural groundwater movement in this area is from the plant site to Lake Michigan. The rate of groundwater flow estimated during site exploration and described in PNP FSAR Section 2.2.1 Groundwater, is 650 feet per year (0.074 feet/hour), which is not considered an aggressive flow rate. Groundwater elevation at the plant site is the same as Lake Michigan (elevation corresponds with lake water level).

Lake Michigan water samples also confirm an aggressive environment does not exist.

Samples from 1962 to1966 of Lake Michigan water at or near the site and 1992 and 2004 site results:

Chemistry/Year	1962-1966	1992	2004
pH	Range 7.6 - 8.2 (>5.5)	8.2	7.9
Chlorides - ppm	Range 5.0 - 32.0 (<500)	11.5	12
Sulfates - ppm	Range 20.0 to 28.0 (<1500)	29	24.4

In addition, PNP FSAR Chapter 2 - Table 2-12 - Analysis of Soil Samples shows that site soil pH of nine samples ranged between 8.1 and 8.5, indicating that soil around and under site structures is also alkaline and does not present an aggressive environment for inaccessible concrete.

In summary, PNP groundwater water sample measurements have confirmed that parameters are well below threshold limits that could cause concrete degradation or corrosion of embedded steel (an aggressive environment does not exist). The rate of groundwater flow is not considered an aggressive flow rate. The

> conditions identified in the GALL Report, as revised by ISG-3, are satisfied; therefore, aging management of cracking, loss of bond, and loss of material (spalling, scaling) due to corrosion of embedded steel for below grade inaccessible concrete is not required.
>
> It is also concluded that it is not necessary to monitor groundwater chemistry over the period of license extension, since it is not credible to postulate that some environmental event will occur in the future that would affect the quality of groundwater in the vicinity of PNP. A change in the environment due to a chemical release would be considered as an "abnormal event." The SRP-LR states that aging effects from abnormal events need not be postulated specifically for license renewal.

During the audit and review, the project team noted that the PNP Structural Monitoring Program AMP does not discuss the need or lack of need to perform periodic ground water monitoring to ensure that the below -grade water chemistry does not become aggressive in the future. The applicant was asked to justify not performing periodic ground water monitoring during the CLB and potential extended license period to check water chemistry for non-aggressiveness.

In a letter dated September 2, 2005, the applicant states that as discussed in PNP LRA Section 3.5.2.2.1.1, ground water chemistry records are available for the current operating period, and provide the basis that water in contact with PNP's below-grade concrete is currently non-aggressive, and has been non-aggressive over at least the last 40 years. To ensure ground water remains non-aggressive over the extended operating period, ground water sampling for pH, chlorides, and sulfates will be performed as part of the Structural Monitoring Program with a periodicity not to exceed every 5 years. Accordingly, changes are made to PNP AMP B2.1.19, Structural Monitoring Program.*

In addition to the above, conforming changes are made in various locations of PNP LRA Section 3.5.2.2 which state that continued groundwater sampling is unnecessary. The new paragraph to be added which replaces the existing paragraph reads as follows: "As part of the Structural Monitoring Program, Palisades will continue to monitor groundwater on a periodic basis to ensure it remains non-aggressive, such that the associated aging effects remain not applicable."

The new paragraph is added to the following PNP LRA location, to replace the existing paragraph, as follows:

> On Page 3-289, replace existing paragraph that begins, "It is also concluded that it is not necessary to monitor groundwater chemistry ..."

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

---

*Reference Section 2.16 of this audit and review report for the evaluation of the specific changes to the PNP AMP.

On the basis of its audit and review, the project team finds that cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel of accessible concrete for Groups 1-5 and 7-9 structures; will be adequately managed by the applicant's Structural Monitoring Program. During the audit and review, the project team interviewed members of the applicant's technical staff and reviewed relevant operating experience to confirm that these aging effects due to this mechanism have not been observed or when observed corrective action taken.

In addition, the project team finds that cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel of Group 1-5 and 7-9 structures inaccessible concrete; are not plausible aging effects due to the nonexistence of this aging mechanism. The applicant states that the design and construction of the reinforced concrete at PNP provides for dense, well cured, and low permeability concrete that provides protection against exposure to an aggressive environment. In addition, the applicant states that groundwater sample measurements have confirmed that the water is not aggressive and the rate of groundwater flow is 650 feet per year, which is also not an aggressive rate. The project team finds that the recommendations of the GALL Report have been satisfied and a plant-specific aging management program for inaccessible Class 1 structures concrete is not required for this aging effect.

The following indented paragraphs are extracted from the PNP LRA. **<u>The project team's evaluation is provided at the end of the indented paragraphs</u>**. In the PNP LRA, the applicant states the following:

> (5) Cracks, Distortion, and Increase in Component Stress Level Due to Settlement
>
> Cracks, distortion, and an increase in component stress level due to settlement are not considered as aging effects requiring management for PNP structures founded highly dense, compacted sand and/or compacted engineered fill. PNP Structures Monitoring Program inspections include monitoring of cracking associated aging effects, irrespective of aging mechanisms.
>
> Concrete structures can be affected by differential settlement between supporting foundations, within the building, or between buildings. For buildings experiencing significant settlement, cracks on structural members may be visibly detected. Cracks, distortion, and an increase in component stress level due to settlement are not considered as aging effects requiring management for PNP structural concrete commodities since they are founded on highly dense, compacted sand, that remained after removal of the sand dunes for site preparation or compacted backfill.
>
> None of the PNP concrete structures require a de-watering system to control settlement, since subsurface conditions of dense compact sand and compacted backfill do not require such a system.
>
> In summary, for concrete structures founded on dense soil or backfill, if in the past 20 years of experience for a structure, the total differential settlement experienced are well within the permissible limits for this type of structure and no settlement has manifested itself via cracked walls or cracked foundations, then it can be concluded that cracking due to settlement is not significant, and would not

be applicable for the structure during the period of extended operation. No settlement monitoring program for PNP structures was formally implemented.

NUREG 0820, "Integrated Plant Safety Assessment, Systematic Evaluation Program, Palisades Plant,…" Final Report October 1982, Letter (NRC) LS05-81-04-020 for Docket No. 50-255; RE: SEP TOPICS II-4.D, STABILITY OF SLOPES AND II-4.F, SETTLEMENT OF FOUNDATIONS AND BURIED EQUIPMENT, provides results of staff inspections and conclusions on the site conditions. On the settlement issue, it was concluded that, "the settlement of foundations and buried equipment will not be a safety problem of concern."

In conclusion, monitoring of accessible concrete for cracks and distortions to settlement will be performed in accordance with the PNP Structures Monitoring Program. Inspection of inaccessible concrete is not required.

On the basis of its audit and review, the project team finds that cracking, distortion, and increase in component stress level due to settlement of Groups 1-3, 5, and 7-9 structures are not plausible aging effects due to the nonexistence of this aging mechanism. The applicant states that the aging effects due to settlement are not expected at PNP for Group 1-3, 5, and 7-9 structures since they are founded on highly dense, compacted sand, that remained after removal of the sand dunes for site preparation. The project team agrees with the applicant that an AMP is not required since these aging effects do not occur at PNP. However, the applicant has conservatively elected to use the Structural Monitoring Program to monitor the above grade exposed concrete of Groups 1-3, 5, and 7-9 structures for the aging effect of cracking due to settlement, which the project team finds acceptable.

The following indented paragraphs are extracted from the PNP LRA. In the PNP LRA, the applicant states the following:

(6) Reduction of Foundation Strength Due to Erosion of Porous Concrete Subfoundation

The PNP concrete structures are on native soil (dense fine sand) and/or engineered fill. There are no porous concrete subfoundations below the building foundations. Therefore, erosion of porous subfoundation cement by ground water is not an issue at PNP. PNP does not have a porous concrete foundation and no subsurface drainage system, as was identified at other facilities in NRC Information Notice 97-11.

In addition, natural groundwater movement in this area is from the plant site to Lake Michigan. The rate of groundwater flow estimated during site exploration and shown in the FSAR, is 650 feet per year (0.074 feet/hour), which is not considered an aggressive flow rate.

On the basis of its audit and review, the project team finds that reduction of foundation strength due to erosion of porous concrete subfoundations of Groups 1-3 and 5-9 structures is not a plausible aging effect due to the nonexistence of the aging mechanism. The applicant states that there are no porous concrete subfoundations below the building foundations for Groups 1-3 and 5-9 structures. The project team agrees with the applicant that an AMP is not required since this aging effect does not occur at PNP.

The following indented paragraphs are extracted from the PNP LRA. In the PNP LRA, the applicant states the following:

> (7) Loss of Material Due to Corrosion of Structural Steel Components
>
> Structural steel commodities potentially subject to loss of material due to corrosion (crevice, pitting, general, MIC) credit the Structural Monitoring Program for aging management. The applicant states that the aging effect of loss of material due to corrosion of steel components for Groups 1-5 and 7-8 structures is managed by the PNP Structural Monitoring Program.

The project team reviewed the AMR results involving management of the aging effect of loss of material resulting from corrosion of structural steel components and confirmed that the PNP AMP Structural Monitoring Program is applied to each of the affected structures. On the basis of this audit and review, the project team finds that the applicant has appropriately evaluated AMR results involving this aging effect and that corrosion of structural steel components is adequately managed by the structures monitoring program and no detailed further evaluation is required.

The following indented paragraphs are extracted from the PNP LRA. In the PNP LRA, the applicant states the following:

> (8) Loss of Strength and Modulus of Concrete Structures Due to Elevated Temperatures
>
> For any concrete elements that exceed specified temperature limits, further evaluations are warranted. 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 that are allowed to have increased temperatures not to exceed 200°F.
>
> General Description Of Auxiliary Building Concrete And Temperatures (GALL Report IIIA3.1-j)
>
> Group 3 structures include auxiliary, diesel generator, radwaste, and turbine buildings: switchgear room, AFW pumphouse, utility/piping tunnels. The water treatment and water purity buildings are also included in this GALL Report group.
>
> The PNP auxiliary building houses:
>
> - Control room
> - Emergency diesel generators and related auxiliaries
> - New and spent fuel handling, storage and shipment facilities
> - Radwaste, chemical and volume control equipment
> - Safety injection system (majority)

- Component cooling system (majority)
- Containment spray system (majority)

None of the areas in the auxiliary building(s) have normal operating temperatures greater than 150°F. The bounding temperature in the Component Cooling Room 338 is 120°F, with other areas at or less than 104°F. The spent fuel pool normal operating temperature is 125°F (Ref. PNP FSAR 5.9.3.3).

Therefore, no further evaluation is required for the auxiliary building.

General Description of Containment Internal Concrete and Temperatures (GALL Report Item IIIA4.1-c)

The principal interior concrete structures and their temperature exposure are:

- The primary shield wall, which forms the reactor cavity is exposed to the highest temperature, 200°F at the cavity liner (further evaluation applies)
- Two steam generator compartments/less than 150°F
- A refueling pool which is located between the steam generator compartments and above the reactor cavity/less than 150°F
- An enclosed sump under the reactor cavity/less than 150°F
- Major equipment supports including the steam generator pedestals/less than 150°F
- The containment floor slab/less than 150°F

The primary shield wall (bioshield) is essentially a circular cylinder, lined with ¼" steel plate, with concrete ranging in thickness from 7' to 8', with the inner 10" thickness acting as a sacrificial shield. The sacrificial shield is not reinforced, except for three horizontal "bands/hoops" of reinforcing steel and is considered non-structural, non-load bearing concrete as evidenced by the existence of the plywood construction form 10" in from the liner (ref. dwg C-153). The primary shield wall cooling coils are in the sacrificial concrete, 3" in from the ¼" liner plate, with cooling coils looping radially outward to provide temperature control of a maximum of 165°F for the outer region of reinforced concrete. Openings in the shield wall for the primary coolant pipelines are lined with ¼" steel plate, with the space between the opening and the piping filled with non-structural concrete block for shielding.

The shield cooling system is designed to remove heat from the biological shield surrounding the reactor vessel thereby limiting the thermal stresses in the structural concrete. The system is designed to maintain structural concrete temperature below 165°F. The system is to assure that the concrete in the reactor cavity does not overheat and develop excessive thermal stress. PNP FSAR Figures 9-5 and 9-6 show the temperature gradient through the shield wall and the temperature 10" in (sacrificial concrete) is less than 180°F and drops to 140°F at 80".

This is judged to be acceptable due to the fact that reductions in excess of 10% in the compressive strength, tensile strength, and the modulus of elasticity only begins to occur in the range of 180°F to 200°F (Reference industry guidance). This is further supported by the fact that 180°F is also the value that the original Bechtel PNP design criteria states the structural concrete is not to exceed (PNP FSAR Section 9.0). The temperature in the structural/load bearing portion of the bioshield is less than 180°F per PNP FSAR Figures 9.5 and 9.6. In addition, concrete mixes are designed in accordance with ACI 613 with 15% more compressive strength than the required design strength. (Specification No. 5935-C-30 for Furnishing and Delivery of Concrete).

Therefore, the conditions identified in the GALL Report are satisfied and aging management of reduction of strength and modulus due to elevated temperature for containment interior concrete components is not required.

The applicant states that during normal operation, all general concrete areas in Group 1-5 Class 1 structures remain below 150°F and local area temperatures remain below 200°F, except for the containment primary shield wall which is exposed to a temperature of 200°F at the cavity liner. Further evaluation therefore applies to the containment primary shield wall. The applicant states that the primary shield wall has a shield cooling system which is designed to remove heat from the shield wall and limit the thermal stresses in the structural concrete. The system is to assure that the concrete in the reactor cavity does not overheat and develop excessive thermal stress. The system is designed to maintain the structural concrete temperature below 165°F. The applicant further states that reductions in excess of 10 percent in the compressive strength, tensile strength, and modulus of elasticity for concrete only start to occur when the temperature range of 180°F to 200°F is reached. The mix for the primary shield wall concrete was designed with 15 percent more compressive strength than the required design strength, so any reduction in concrete strength properties due to elevated temperatures are compensated for by the stronger mix. Therefore, the applicant's further evaluation concludes that change in material properties of concrete due to elevated temperature is an aging effect not requiring management for PNP Groups 1-5 Class 1 structures.

On the basis of its audit and review, the project team finds the applicant's further evaluation acceptable and finds that change in material properties due to elevated temperature is an aging effect not requiring management for the PNP Groups 1-5 Class 1 structures.

The following indented paragraphs are extracted from the PNP LRA. In the PNP LRA, the applicant states the following:

(9) Crack Initiation and Growth Due to SCC and Loss of Material Due to Crevice Corrosion of Stainless Steel Liner

To foster SCC, a temperature threshold of 140°F or a continuous temperature environment of 200°F is necessary. The maximum temperature in the auxiliary building or containment building for fuel-related components is 125°F. The normal temperature for the spent fuel pool is maintained below 125°F, and maximum allowed temperature is not to exceed 140°F. Therefore, the temperature threshold to foster stress corrosion cracking/IGA is not present, and no aging management is required.

The applicant states in the PNP LRA, that the maximum temperature for fuel related components in Group 7 and 8 structures at PNP is 125°F. A temperature threshold of 140°F or a continuous temperature environment of 200°F is necessary for susceptibility to SCC. Therefore, the low temperature environment of stainless steel liners in Group 7 and 8 structures does not warrant the need for a aging management program, since the aging effects of crack initiation and growth and loss of material will not occur.

On the basis of its audit and review, the project team concurs that no aging management program is required for the above aging effects for stainless steel liners for Group 7 and 8 structures.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.1 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.2 Aging Management of Inaccessible Areas (PNP LRA Section 3.5.2.2.2.2)

The project team reviewed PNP LRA Section 3.5.2.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2.2.

SRP-LR Section 3.5.2.2.2.2 states that cracking, spalling, and increases in porosity and permeability due to aggressive chemical attack and cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel could occur in below-grade inaccessible concrete areas. The GALL Report recommends further evaluation to manage these aging effects in inaccessible areas of Groups 1-3, 5, 7-9 structures, if specific criteria defined in the GALL report cannot be satisfied.

The applicant states, in the PNP LRA, that for inaccessible concrete components, such as exterior walls below grade and foundations for Groups 1-3, 5, 7-9, the aging effects of cracking, spalling, and increases in porosity and permeability due to aggressive chemical attack and cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel are not applicable to PNP.

During the audit and review, the project team noted that the PNP Structural Monitoring Program AMP does not discuss the need or lack of need to perform periodic ground water monitoring to ensure that the below -grade water chemistry does not become aggressive in the future. The applicant was asked to justify not performing periodic ground water monitoring during the CLB and potential extended license period to check water chemistry for non-aggressiveness.

In a letter dated September 2, 2005, the applicant states that as discussed in PNP LRA Section 3.5.2.2.1.1, ground water chemistry records are available for the current operating period, and provide the basis that water in contact with PNP's below-grade concrete is currently non-aggressive, and has been non-aggressive over at least the last 40 years. To ensure ground water remains non-aggressive over the extended operating period, ground water sampling for pH, chlorides, and sulfates will be performed as part of the Structural Monitoring

Program with a periodicity not to exceed every 5 years. Accordingly, changes are made to PNP AMP B2.1.19, Structural Monitoring Program.*

In addition to the above, conforming changes are made in various locations of PNP LRA Section 3.5.2.2 which state that continued groundwater sampling is unnecessary. The new paragraph to be added which replaces the existing paragraph reads as follows: “As part of the Structural Monitoring Program, Palisades will continue to monitor groundwater on a periodic basis to ensure it remains non-aggressive, such that the associated aging effects remain not applicable.”

> On Page 3-297 replace existing paragraph that begins, “It is also concluded that formal groundwater monitoring ...”
>
> On Page 3-298, replace existing paragraph that begins, “It is also concluded that formal groundwater monitoring ...”

On the basis of its review of the applicant’s response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

The applicant states that PNP Groups 1-3, 5, 7-9 Class 1 structures are designed in accordance with ACI 318-63 and meet the requirements of ACI 201.2R-77, which results in good quality, dense, well cured, and low permeability concrete and provides an acceptable degree of protection against an aggressive environment. In addition, the applicant states that the rate of groundwater flow is 650 feet per year, which is not an aggressive rate.

The project team determined through discussions with the applicant’s technical staff and review of the PNP LRA that the recommendations of the GALL Report have been satisfied and a plant-specific aging management program for inaccessible concrete of Class 1 (Groups 1-3, 5, 7-9) structures is not required for these nonexistent aging effects and aging mechanisms.

On the basis that PNP does not have an aggressive environment aging mechanism for inaccessible concrete, the project team finds that these aging effects (cracking, spalling, increases in porosity and permeability, loss of bond, loss of material) are not applicable to PNP Groups 1-3, 5, 7-9 Class 1 structures.

3.5.2.3 Component Supports (PNP LRA Section 3.5.2.2.3)

The project team reviewed PNP LRA Section 3.5.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.3, which addresses several areas discussed below.

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*Reference Section 2.16 of this audit and review report for the evaluation of the specific changes to the PNP AMP.

3.5.2.3.1 Aging of Supports Not Covered by Structures Monitoring Program (PNP LRA Section 3.5.2.2.3.1)

The project team reviewed PNP LRA Section 3.5.2.2.3.1 against the criteria in SRP-LR Section 3.5.2.2.3.1.

SRP-LR Section 3.5.2.2.3.1 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) reduction in concrete anchor capacity due to degradation of the surrounding concrete, for Groups B1-B5 supports; (2) loss of material due to environmental corrosion, for Groups B2-B5 supports; and (3) reduction/loss of isolation function due to degradation of vibration isolation elements, for Group B4 supports. Further evaluation is necessary only for structure/aging effect combinations not covered by the structures monitoring program.

In PNP LRA Section 3.5.2.2.3.1, the applicant addresses aging of support members (all groups) including anchor bolts, concrete surrounding anchor bolts, welds, grout pad, bolted connections, etc., not covered by the structures monitoring program. The PNP LRA states that GALL Report Items III.B1.1.4-a, III.B1.2.3-a, III.B2.2-a, III.B3.2-a, III.B4.3-a, and III.B5.2-a discuss aging effect/mechanism: reduction in anchor bolt capacity due to local concrete degradation/service induced cracking. The GALL Report requires further evaluation of this aging effect and mechanism if the Structures Monitoring Program does not have this aging effect and mechanism within the scope of license renewal. The PNP Structural Monitoring Program includes local concrete degradation/service induced cracking within the scope of license renewal. Therefore, the applicant states that no further evaluation is required.

The applicant also states, in the PNP LRA, that GALL Report Items III.B2.1-a, III.B3.1-a, III.B4.1-a, and III.B5.1-a discuss Aging Effect/Mechanism: Loss of Material due to Environmental Corrosion (i.e., pitting corrosion, general corrosion, etc.). The GALL Report requires further evaluation of this aging effect and mechanism if the Structures Monitoring Program does not have this aging effect and mechanism within the scope of license renewal. The PNP Structural Monitoring Program includes loss of material due to environmental corrosion (i.e., pitting corrosion, general corrosion, etc.) within the scope of license renewal. Therefore, the applicant states that no further evaluation is required.

In addition, the applicant states, in the PNP LRA, that GALL Report Item III.B4.2-a discusses vibration isolation elements and aging effect/mechanism: reduction or loss of isolation function due radiation hardening, temperature, humidity, sustained vibratory loading. The PNP Structural Monitoring Program is credited with age managing vibration isolation elements for the emergency diesel generator. Therefore, the applicant states that no further evaluation is required.

The project team finds that the applicant has included the above aging effect combinations within the scope of the PNP Structural Monitoring Program and agrees that no further evaluation is required. The project team reviewed the Structural Monitoring Program and its evaluation is documented in Section 2.16 of this audit and review report. The project team finds the Structures Monitoring Program acceptable for managing aging of component supports for all GALL Report component support groups.

The project team finds that, based on the program identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.3.1 for further evaluation. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.2 Cumulative Fatigue Damage Due to Cyclic Loading (PNP LRA Section 3.5.2.2.3.2)

PNP LRA Section 3.5.2.2.3.2 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 TLAA is reviewed by the NRR DE staff. The evaluation of this TLAA will be addressed separately in Section 4 of the SER related to the PNP LRA.

Conclusion

On the basis of its audit and 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 these issues. For these items, the project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.3 Aging Management Review Results That Are Not Consistent with the GALL Report or Not Addressed in the GALL Report

In PNP LRA Tables 3.5.2-1 through 3.5.2-10, 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.

3.5.3.1 Structures and Component Supports AMR Line Items with No Aging Effect (PNP LRA Tables 3.5.2-1 through 3.5.2-10)

In PNP LRA Tables 3.5.2-1 through 3.5.2-10, the applicant identified line items where no aging effects were identified as a result of the aging review process.

In PNP LRA Tables 3.5.2-1 through 3.5.2-10, the applicant identified AMR results line-items where aging effects were listed and none shown under the AMP column required to manage the aging effect. The applicant elected to list an aging effect in the table even though its review concluded that the aging effect would not actually occur and no AMP was required. Specifically, instances in which the applicant lists an aging effect in the tables, for which its evaluation shows will not actually occur, are when components fabricated from stainless steel material are exposed to an environment of treated water at a temperature of less than 140°F. No aging effects are considered to be applicable to components fabricated from stainless steel material exposed to a treated water environment of less than 140°F temperature.

On the basis of its audit and review of current industry research and operating experience, the project team finds that less than 140°F temperature treated water on stainless steel will not result in aging that will be of concern during the period of extended operation. The project team finds that the applicant's AMR evaluation that stainless steel in less than 140°F temperature treated water will have no identified aging effects that actually occur, acceptable. Therefore, the project team concludes that there are no applicable aging effects requiring management for stainless steel components exposed to a less than 140°F temperature treated water environment.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-1 (Page 3-312) for component type fuel related component - stainless, borated, GALL Report Item III.A5.2-b is referenced. The environment shown in the GALL Report is "exposed to water" with an aging effect of crack initiation and growth. The GALL Report has no criteria about the temperature of the water for which no aging would occur. During the audit and review, the project team asked the applicant to explain why there is no aging management program required to prevent cracking of the stainless steel liners since the GALL Report is not concerned with the temperature of the water the liners are exposed to.

In a letter dated August 27, 2005, the applicant states that a temperature threshold of 140°F is from industry guidance. The applicability criteria for cracking due to SCC is given as a temperature > 140°F and chlorides, or fluorides, or sulfates > 150ppb. Additionally, Table IX.D of the draft Revision 1 GALL Report also identifies 140°F as the SCC threshold for SCC in treated water. It is worth noting that the loss of material due to the crevice corrosion portion of the same line item (III.A5.2-b) IS considered an AERM and the Water Chemistry Program and monitoring of the fuel pool level per the technical specifications is credited for aging management, consistent with the GALL Report. It was noted that a more appropriate note for the AMR cracking line item would be a Note H rather than the Note E in the PNP LRA. Note E is changed to Note H as indicated in the response.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism.

In PNP LRA Tables 3.5.2-1 through 3.5.2-10, the applicant identified AMR results line-items where aging effects were listed and none shown under the AMP column required to manage the aging effect. The applicant elected to list an aging effect in the table even though its review concluded that the aging effect would not actually occur and no AMP was required. Specifically, instances in which the applicant states that aging effects were identified, but will not occur, are when components fabricated from bronze/lubrite plate material were exposed to a containment air or plant indoor air environment. The project team finds that operating experience and ISI inspection reports for slide bearing plates have identified no recordable degradation due to any aging effects. No aging effects are considered to be applicable to components fabricated from bronze/lubrite plate material exposed to containment air or plant indoor air environments.

On the basis of its audit and review of current industry research and operating experience, the project team finds that containment air or plant indoor air on bronze/lubrite plate will not result in aging that will be of concern during the period of extended operation. The project team finds that the applicant's AMR evaluation that bronze/lubrite plate in containment air or plant indoor air will have no identified aging effects that actually occur, acceptable. Therefore, the project team concludes that there are no applicable aging effects requiring management for bronze/lubrite plate components exposed to a containment air or plant indoor air environment.

3.5.3.2 Structures and Component Supports - Auxiliary Building - Summary of Aging Management Evaluation - (PNP LRA Table 3.5.2-1)

The project team reviewed PNP LRA Table 3.5.2-1, which summarizes the results of AMR evaluations for the auxiliary building component groups. The project team finds that for the project team's scope of AMR evaluations, all AMR evaluation results in PNP LRA Table 3.5.2-1 are consistent with the GALL Report, or discussed below.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-1 (Page 3-312) for component type fuel related component - carbon steel, protected, GALL Report Item III.A5.2-b is referenced. The environment shown in the GALL Report is exposed to water. The PNP LRA AMR line item has an environment of plant indoor air. During the audit and review, the project team asked the applicant to explain how the applicant's Water Chemistry Program manages loss of material in a plant indoor air environment.

In a letter dated August 27, 2005, the applicant states that the aging effect/mechanism in question is loss of material/boric acid corrosion. Although the carbon steel anchor bolts are protected from boric acid by the liner plate, PNP conservatively credited the aging management program used for the liner plate to preclude boric acid leakage past the liner. The following comment is included in the AMR evaluation: anchor bolts for the spent fuel pool gates, spent fuel pool liner, fuel tilt pool liner, and appurtenances for the fuel transfer tube are protected from exposure to corrosive environments by the stainless steel liners and transfer tube. The liners and transfer tube are age managed by the SFP Water Chemistry Program and technical specification surveillance of SFP water levels. Ensuring minimal leakage from the liners will ensure the potential boric acid wastage is minimized as well. Anchor bolt degradation could result in damage to the SFP liner which would be made evident via SFP level monitoring. On further evaluation, it is evident that this component is redundant to component type building framing - concrete, protected that, in the full description of components included for this concrete type in the scoping report, includes embedded steel reinforcements and shapes. Thus, this AMR line item component type is deleted from the PNP LRA. There is a similar component in Table 3.5.2-4 (Page 3-347), entitled fuel related component - carbon steel, protected. It is also deleted in the PNP LRA.

On the basis of a review of the applicant's response, the project team finds that the deletion of the AMR line item eliminates the discrepancy. The project team finds this acceptable.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism.

3.5.3.3 Structures and Component Supports - Component Supports - Summary of Aging Management Evaluation - (PNP LRA Table 3.5.2-2)

The project team reviewed PNP LRA Table 3.5.2-2, which summarizes the results of AMR evaluations for the component supports component groups.

In PNP LRA Table 3.5.2-2, the applicant proposes to manage loss of material from aluminum ASME Class 2 and 3 piping, mechanical, and non-ASME component supports exposed to an atmosphere/weather, plant indoor air or containment air (all with borated water leakage in air) environment using PNP AMP B2.1.4, "Boric Acid Corrosion Program."

The Boric Acid Corrosion Program is reviewed by the NRR DE staff and will be addressed separately in Section 3 of the SER related to the PNP LRA. The Boric Acid Corrosion Program monitors component degradation due to boric acid leakage through the performance of periodic inspections. On the basis of its audit and review of the applicant's plant-specific and industry operating experience, the project team finds that, predicated on DE's acceptance of the Boric Acid Corrosion Program, the aging effect of loss of material of aluminum material exposed to an atmosphere/weather, plant indoor air or containment air (all with borated water leakage in air) environment is effectively managed using the Boric Acid Corrosion Program. On this basis, the project team finds that management of loss of material in component supports is acceptable.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-2 (Page 3-331) for component type non-ASME component support-auxiliary building, aluminum, protected, a GALL Report line item and a Table 1 item are shown with a Note F. During the audit and review, the project team asked the applicant to explain why a GALL Report line item and a Table 1 item are shown with a Note F.

In a letter dated August 27, 2005, the applicant states that as indicated in plant-specific Note 503, component type "Non-ASME Component Support-Auxiliary Bldg, Aluminum, Protected" represents the new fuel storage racks, which is the component represented by GALL Report Item VII.A1.1-a. PNP new fuel racks are aluminum whereas the GALL Report line item is for carbon steel racks. Hence, Note F, material not in the GALL Report for this component, is assigned. However, since neither the material or program match, alignment with the GALL Report line item is not appropriate. For this AMR line item, the GALL Report and Table 1 line items are only removed, leaving Notes F and 503 intact.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism.

3.5.3.4 Structures and Component Supports - Containment - Summary of Aging Management Evaluation - (PNP LRA Table 3.5.2-3)

The project team reviewed PNP LRA Table 3.5.2-3, which summarizes the results of AMR evaluations for the containment component groups. The project team finds that for the project team's scope of AMR evaluations, all AMR evaluation results in PNP LRA Table 3.5.2-3 are consistent with the GALL Report.

3.5.3.5 Structures and Component Supports - Containment Interior Structures - Summary of Aging Management Evaluation - (PNP LRA Table 3.5.2-4)

The project team reviewed PNP LRA Table 3.5.2-4, which summarizes the results of AMR evaluations for the containment interior structures component groups. The project team finds that for the project team's scope of AMR evaluations, all AMR evaluation results in PNP LRA Table 3.5.2-4 are consistent with the GALL Report, or if not consistent, previously discussed in Section 3.5.1.5 of this audit and review report.

3.5.3.6 Structures and Component Supports - Discharge Structure - Summary of Aging Management Evaluation - (PNP LRA Table 3.5.2-5)

The project team reviewed PNP LRA Table 3.5.2-5, which summarizes the results of AMR evaluations for the discharge structure component groups. The project team finds that for the project team's scope of AMR evaluations, all AMR evaluation results in PNP LRA Table 3.5.2-5 are consistent with the GALL Report.

3.5.3.7 Structures and Component Supports - Feedwater Purity Building - Summary of Aging Management Evaluation - (PNP LRA Table 3.5.2-6)

The project team reviewed PNP LRA Table 3.5.2-6, which summarizes the results of AMR evaluations for the feedwater purity building component groups. The project team finds that for the project team's scope of AMR evaluations, all AMR evaluation results in PNP LRA Table 3.5.2-6 are consistent with the GALL Report.

3.5.3.8 Structures and Component Supports - Intake Structure - Summary of Aging Management Evaluation - (PNP LRA Table 3.5.2-7)

The project team reviewed PNP LRA Table 3.5.2-7, which summarizes the results of AMR evaluations for the intake structure component groups. The project team finds that for the project team's scope of AMR evaluations, all AMR evaluation results in PNP LRA Table 3.5.2-7 are consistent with the GALL Report.

3.5.3.9 Structures and Component Supports - Miscellaneous Structural and Bulk Commodities - Summary of Aging Management Evaluation - (PNP LRA Table 3.5.2-8)

The project team reviewed PNP LRA Table 3.5.2-8, which summarizes the results of AMR evaluations for the miscellaneous structural and bulk commodities component groups.

In PNP LRA Table 3.5.2-8, the applicant proposes to manage change in material properties, loss of form and loss of material of built-up roofing materials for component types of roofing exposed to an atmosphere/weather environment using PNP AMP B2.1.19, “Structural Monitoring Program.”

The project team reviewed the applicant's Structural Monitoring Program and its evaluation is documented in Section 2.16 of this audit and review report. The Structural Monitoring Program is designed to ensure that age related (as well as other) deterioration of plant structures (including masonry walls) and components within its scope is appropriately managed to ensure that each such structure or component retains the ability to perform its intended function. The project team accepts the position that change in material properties, loss of form and loss of material exhibited by built-up roofing in an atmosphere/weather environment is properly managed by the Structural Monitoring Program, which through visual examination inspects the built-up roofing for any sign of aging degradation. On the basis of its audit and review of the applicant's plant-specific and industry operating experience, the project team finds the aging effects of change in material properties, loss of form and loss of material of built-up roofing materials for component types of roofing exposed to an atmosphere/weather environment are effectively managed using the Structural Monitoring Program. On this basis, the project team finds that management of change in material properties, loss of form and loss of material of built-up roofing materials in miscellaneous structural and bulk commodities is acceptable.

In PNP LRA Table 3.5.2-8, the applicant proposes to manage loss of material of concrete materials for component types of fire barrier exposed to a plant indoor air environment using PNP AMP B2.1.19, “Structural Monitoring Program,” in conjunction with PNP AMP B2.1.10, “Fire Protection Program.”

The project team reviewed the applicant’s Structural Monitoring Program and Fire Protection Program and their evaluations are documented in Sections 2.16 and 2.8 of this audit and review report, respectively. The Structural Monitoring Program is designed to ensure that age related (as well as other) deterioration of plant structures (including masonry walls) and components within its scope is appropriately managed to ensure that each such structure or component retains the ability to perform its intended function. The Fire Protection Program includes (a) fire barrier inspections, (b) electric and diesel-driven fire pump tests, and (c) periodic maintenance, testing, and inspections of water-based fire protection systems. On the basis of its audit and review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effect of loss of material of concrete materials for component types fire barrier exposed to a plant indoor air environment is effectively managed using the Structural Monitoring Program and the Fire Protection Program. On this basis, the project team finds that management of loss of material of concrete materials in miscellaneous structural and bulk commodities is acceptable.

In PNP LRA Table 3.5.2-8, the applicant proposes to manage loss of material of fire stop (sealant/maranite) materials for component types fire barrier exposed to a plant indoor air environment using PNP AMP B2.1.10, “Fire Protection Program.”

The project team reviewed the applicant’s Fire Protection Program and its evaluation is documented in Section 2.8 of this audit and review report. The Fire Protection Program includes (a) fire barrier inspections, (b) electric and diesel-driven fire pump tests, and (c) periodic maintenance, testing, and inspections of water-based fire protection systems. On the basis of its audit and review of the applicant’s plant-specific and industry operating experience, the project team finds the aging effects of loss of material of fire stop (sealant/maranite) material for component types of fire barrier exposed to a plant indoor air environment are effectively managed using the Fire Protection Program. On this basis, the project team finds that management of loss of material of fire stop (sealant/maranite) material in miscellaneous structural and bulk commodities is acceptable.

In PNP LRA Table 3.5.2-8, the applicant proposes to manage cracking and loss of material of fire wrap materials for component types fire barrier exposed to an plant indoor air environment using PNP AMP B2.1.10, “Fire Protection Program.”

The project team reviewed the applicant’s Fire Protection Program and its evaluation is documented in Section 2.8 of this audit and review report. The Fire Protection Program includes (a) fire barrier inspections, (b) electric and diesel-driven fire pump tests, and (c) periodic maintenance, testing, and inspections of water-based fire protection systems. The project team accepts the position that cracking and loss of material exhibited by fire wraps in a plant indoor environment is properly managed by the Fire Protection Program, which through visual examination inspects the fire wraps for any sign of aging degradation. On the basis of its audit and review of the applicant's plant-specific and industry operating experience, the project team finds the aging effects of cracking and loss of material of fire wraps for component types fire barrier exposed to a plant indoor air environment are effectively managed using the Fire Protection Program. On this basis, the project team finds that management of cracking and loss of material of fire wrap materials in miscellaneous structural and bulk commodities is acceptable.

In PNP LRA Table 3.5.2-8, the applicant proposes to manage change in material properties and cracking of elastomer materials for component types of flood barrier, HELB/MELB and EQ civil/structural components and seal, gasket or filler exposed to a plant indoor air, containment air or atmosphere/weather environment using PNP AMP B2.1.19, "Structural Monitoring Program."

The project team reviewed the applicant's Structural Monitoring Program and its evaluation is documented in Section 2.16 of this audit and review report. The Structural Monitoring Program is designed to ensure that age related (as well as other) deterioration of plant structures (including masonry walls) and components within its scope is appropriately managed to ensure that each such structure or component retains the ability to perform its intended function. The project team accepts the position that change in material properties and cracking exhibited by elastomers in a plant indoor air, containment air or atmosphere/weather environment is properly managed by the Structural Monitoring Program, which through visual examination inspects the elastomers for any sign of aging degradation. On the basis of its audit and review of the applicant's plant-specific and industry operating experience, the project team finds the aging effects of change in material properties and cracking for component types of flood barrier, HELB/MELB and EQ civil/structural components and seal, gasket or filler exposed to a plant indoor air, containment air or atmosphere/weather environment are effectively managed using the Structural Monitoring Program. On this basis, the project team finds that management of change in material properties and cracking of elastomer materials in miscellaneous structural and bulk commodities is acceptable.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-8 (Page 3-372) for component type seal, gasket or filler - auxiliary building - elastomer, exposed, the only aging effect shown is cracking. During the audit and review, the project team asked the applicant to explain why change in material properties is not another aging effect for this component like it is for identical component types in other buildings.

In a letter dated August 27, 2005, the applicant states that a review of the AMR basis document indicates that change of material properties was evaluated as an aging effect requiring management with the Structural Monitoring Program credited with age managing it and a standard Note J applied. The PNP LRA should include the change in material properties AERM with Note J applied. For this AMR line item, the subject AERM is added to Table 3.5.2-8 with a Note J.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-8 (Page 3-373) for component type seal gasket or filler - auxiliary bldg - elastomer, protected, the two aging effects shown are change in material properties and cracking with the referenced GALL Report

Item III.B4.2-a and Table 3.5.1, Item 3.5.1-29. GALL Report Item III.B4.2-a lists an aging effect of reduction or loss of isolation function with the component vibration isolation elements. During the audit, the project team asked the applicant to explain how this PNP LRA AMR line item has a Note A, consistent with the GALL Report, when the component type and aging effects shown are different from the GALL Report line item. The intended function of vibration isolation is also not shown in the PNP LRA AMR line item.

In a letter dated August 27, 2005, the applicant states that the answer to this question is provided in plant-specific Note 593 which is included in the PNP LRA Table line item. Restating it here: "Aging effect terminology used in the GALL Report for the Emergency Diesel Generators vibration isolation elements is slightly different, but overall deterioration is the same (e.g., cracking and change in material properties due to thermal exposure, etc.). Other elements included in this component (thermal expansion/seismic separation joint filler, gap or crack seal, etc.) are not addressed in the GALL." With regards to the intended function, the expansion/separation intended function is considered applicable to vibration isolation. Additional clarification is required to explain the consistency between the GALL Report aging effect of loss of vibration isolation and that of the evaluated aging effects that support the expansion/separation intended function summarized in the PNP LRA. Additionally, better clarification is required to describe the other components included in the component type and that they do not align with GALL Report Item III.B.4a and require a Note J, consistent with other elastomers in the table. A revision to Note 593 is made to incorporate the subject clarifications. The revised response includes the addition of Note J to the line item in the table, in addition to the existing Note A, for the other components in the group.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-8 (Page 3-364) for component type fire barrier-auxiliary building-concrete, protected, a GALL Report line item and a Table 1 item are shown with a Note H for the aging effect loss of material. During the audit and review, the project team asked the applicant to explain why a GALL Report line item and a Table 1 item are shown with a Note H.

In a letter dated September 2, 2005, the applicant states that in PNP LRA Table 3.5.2-8 (Page 3-364), for the loss of material AERM of component type fire barrier - auxiliary building - concrete, protected, the GALL Report Volume 2 and Table 1 entries for the Fire Protection Program and the Structural Monitoring Program are deleted.

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism.

During the audit and review, the project team noted that in PNP LRA Table 3.5.2-8 (Page 3-364) for component type fire barrier-auxiliary building - fire stop, protected, a GALL Report line item and a Table 1 item are shown with a Note H for the aging effect loss of material. During the audit and review, the project team asked the applicant to explain why a GALL Report line item and a Table 1 item are shown with a Note H. Also applies to PNP LRA Table 3.5.2-8 (Page 3-366) for component type fire barrier - intake structure building - fire stop, protected for aging effect loss of material; to PNP LRA Table 3.5.2-8 (Page 3-368) for component type fire barrier - turbine building - fire stop, protected for aging effect loss of material, and to PNP LRA

Table 3.5.2-8 (Page 3-370) for component type fire barrier - water treatment building - fire stop, protected for aging effect loss of material.

In a letter dated September 2, 2005, the applicant states that in PNP LRA Table 3.5.2-8 (Page 3-364), for the loss of material AERM of component type fire barrier - auxiliary bldg - fire stop, protected, the GALL Report Volume 2 and Table 1 entries for the Fire Protection Program are deleted.

The same deletions of the GALL Report Volume 2 and Table 1 information are also made to the loss of material AERMs of the following additional line items of PNP LRA Table 3.5.2-8 which have standard Note H:

- Page 3-366, Fire Barrier - Intake Structure Bldg - Fire Stop, Protected
- Page 3-368, Fire Barrier - Turbine Bldg - Fire Stop, Protected
- Page 3-370, Fire Barrier - Water Treatment Bldg - Fire Stop, Protected

On the basis of its review of the applicant's response, the project team finds the response acceptable and the applicant has appropriately addressed the aging effect/mechanism.

3.5.3.10 Structures and Component Supports - Switchyard and Yard Structures - Summary of Aging Management Evaluation - (PNP LRA Table 3.5.2-9)

The project team reviewed PNP LRA Table 3.5.2-9, which summarizes the results of AMR evaluations for the switchyard and yard structures component groups. The project team finds that for the project team's scope of AMR evaluations, all AMR evaluation results in PNP LRA Table 3.5.2-9 are consistent with the GALL Report.

3.5.3.11 Structures and Component Supports - Turbine Building - Summary of Aging Management Evaluation - (PNP LRA Table 3.5.2-10)

The project team reviewed PNP LRA Table 3.5.2-10, which summarizes the results of AMR evaluations for the turbine building component groups. The project team finds that for the project team's scope of AMR evaluations, all AMR evaluation results in PNP LRA Table 3.5.2-10 are consistent with the GALL Report, or if not consistent, previously discussed in Section 3.5.1.10 of this audit and review report.

Conclusion

On the basis of its audit and review, the project team finds 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 finds 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 PNP LRA Section 3.6 - Aging Management of Electrical Components

In PNP LRA Section 3.6, the applicant provided the results of its AMRs for the electrical components.

In PNP LRA Table 3.6.2-1, the applicant provided a summary of the AMR results for component types associated with the electrical commodity groups. The summary information for each component type included intended function; material; environment; aging effect requiring management; AMPs; the GALL Report Volume 2 item; cross reference to PNP LRA Table 3.6.1 (Table 1); and generic and plant-specific notes related to consistency with the GALL Report.

Also, the applicant identified for each component type in PNP LRA Table 3.6.1 those components that are consistent with the GALL Report, those components which the GALL Report recommends further evaluation, and those components that are not addressed in the GALL Report together with the basis for their exclusion.

The project team's review of PNP LRA Section 3.6 identified an area in which additional information was necessary to complete the review of the applicant's AMR review results. The applicant responded to the project team's RAI as discussed below.

RAI-3.6.2-1. In the notes area for Table 3.6.2-1 (and in other notes for other tables) various components are described; however, they are not specified in the associated table. For example, are neutron monitoring cables and uninsulated ground connectors within the scope of license renewal? Where are they located in the associated PNP LRA tables?

In its response, dated July 1, 2005, the applicant states that the referenced plant-specific notes are associated with a particular line item in PNP LRA Table 3.6.2-1. The plant-specific note applicable to neutron monitoring cables is Note 602 (Page 3-418), which is referenced in the second row of PNP LRA Table 3.6.2-1 (Page 3-415). Neutron monitoring cables are within the scope of license renewal and are included in the listed commodity, "Electrical Cables and Connections Used in Instrumentation Circuits Not Subject to 10 CFR 50.49 EQ Requirements That Are Sensitive to Reduction in Conductor IR. (ISG-15) (Nuclear Instrumentation and Radiation Monitoring Systems)."

In addition, to its response of RAI-3.6.2-1, the applicant states that uninsulated ground conductors are not referenced in PNP LRA Table 3.6.2-1, as they are not within the scope of license renewal. The PNP plant uninsulated grounding cables are installed to provide personnel safety and economic equipment protection, and are not associated with supporting any system or component license renewal intended function. This is described in the fifth paragraph of FSAR Section 8.3.1.2 which states "The 4,160 volt switchgear is provided with relay protection, grounding and the mechanical safeguards necessary to assure adequate personnel protection and to prevent or limit equipment damage during system fault conditions."

Based on the above discussion, the project team finds the applicant's response to RAI-3.6.2-1 is acceptable because the requested clarification is provided. The project team's concern described in RAI-3.6.2-1 is resolved.

The project team conducted its audit and review in accordance with SRP-LR Section 3.6.3 and the PNP audit and review plan. The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report, including basis document, LR-AMPBD-17-NONEQELECOM, "Non-EQ Electrical Commodities Condition Monitoring Program."

3.6.1 Aging Management Review Results That Are Consistent with the GALL Report

For aging management evaluations that the applicant states are consistent with the GALL Report, the project team conducted its audit and review to determine if the applicant's reference to the GALL Report in the PNP LRA is acceptable.

The project team reviewed its assigned PNP LRA line-items to determine that the applicant (1) provides a brief description of the system, components, materials, and environment; (2) states that the applicable aging effects have been reviewed and are evaluated in the GALL Report; and (3) identifies those aging effects for the electrical commodity groups components that are subject to an AMR.

The following subparagraphs identify differences, when compared to the GALL Report, that were identified by the project team during the audit.

3.6.1.1 Radiolysis and Photolysis (Ultraviolet Sensitive Materials Only) of Organics

The GALL Report, Volume 2, Line Item VI.A.1-a, identified radiolysis and photolysis (ultraviolet [uv] sensitive materials only) of organics as aging effects/mechanisms of cable and connection insulations. The project team requested that the applicant provide a basis why those aging mechanisms are not applicable to PNP. In a letter dated August 25, 2005, the applicant states that this aging effect (radiolysis and photolysis (ultraviolet [uv] sensitive materials only) of organics mechanism is applicable and will be added to PNP LRA Table 3.6.2-1 for the electrical cables and connections not subject to 10 CFR 50.49 EQ, (Page 3-414). The project team finds the response acceptable because the applicant identified the aging effect which is consistent with the GALL Report.

The GALL Report, Volume 2, Line Item VI.A.1-b identified radiolysis and photolysis (ultraviolet [uv] sensitive materials only) of organics as aging effects/mechanisms of cable and connection insulations used in instrumentation circuits that are sensitive to reduction in conductor insulation resistance. The project team requested that the applicant provide a basis as to why those aging mechanisms are not applicable to PNP. In a letter dated August 25, 2005, the applicant states that this aging effect (radiolysis and photolysis (ultraviolet [uv] sensitive materials only) of organics mechanism is applicable and will be added to PNP LRA Table 3.6.2-1 for the electrical cables and connections not subject to 10 CFR 50.49 EQ (Page 3-415) used in instrumentation circuits. The project team finds the response acceptable because the aging effects identified above is consistent with the GALL Report.

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 finds that the AMR results, which the applicant claims to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the project team finds 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 Aging Management Review Results for Which Further Evaluation Is Recommended by the GALL Report

For some line-items assigned to the project team in PNP LRA Table 3.6.2-1, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in PNP LRA Section 3.6.2.2 against the criteria provided in SRP-LR Section 3.6.2.2. The project team's assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 line-item in Section 3.6 citing the item in Table 1.

3.6.2.1 Electrical Equipment Subject to Environmental Qualification (PNP LRA Section 3.6.2.2.1)

PNP LRA Section 3.6.2.2.1 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 TLAA is reviewed by the NRR DE staff. The evaluation of this TLAA will be addressed separately in Section 4 of the SER related to the PNP 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 these issues. For these items, the project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.3 Aging Management Review Results That Are Not Consistent with the GALL Report or Not Addressed in the GALL Report

In PNP LRA Table 3.6.2-1, 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.

3.6.3.1 Electrical Component Systems AMR Line Items with No Aging Effect (PNP LRA Table 3.6.2-1)

In PNP LRA Table 3.6.2-1, no item was listed unless an aging effect requiring management had been identified through the aging management review process.

During the audit and review, the project team reviewed the AMR basis documents for electrical component systems. Specifically, the project team audited components having a material and environment combination for which no aging management program is recommended by the GALL Report. The project team found that every aging effect requiring management is reported in PNP LRA Table 3.6.2-1. Furthermore, the project team finds that the intended functions of components within the scope of license renewal but not requiring aging management will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.3.2 Electrical Components - Electrical Commodity Groups - Summary of Aging Management Evaluation (PNP LRA Table 3.6.2-1)

The project team reviewed PNP LRA Table 3.6.2-1, which summarizes the results of AMR evaluations for the electrical commodity groups.

Fuse Holder

In PNP LRA Table 3.6.2-1, the applicant identified AMR results line-items where no aging management programs were identified as a result of the aging review process even though aging effects were identified. Specifically, instances in which the applicant states that no aging effects were identified occurred when components fabricated from phenolic, copper, and aluminum material exposed to adverse localized environment caused by heat, radiation, or moisture in the presence of an oxygen environment.

Interim Staff Guidance (ISG)-5, “Interim Staff Guidance on the Identification and Treatment of Electrical Fuse Holders for License Renewal,” identified aging effects of metallic portions of fuse holders including fatigue/ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation. The environment for fuse holders is air indoor/adverse localized environment. The project team requested that the applicant identify environments and aging effects for fuse holders and provide an AMP with ten program elements or justification why an AMP is not required for fuse holders. In a letter dated August 25, 2005, the applicant states that the aging effects (fatigue/ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation) and environment (air indoor/adverse localized environment) are applicable and will be added to PNP LRA Table 3.6.2-1 (Page 3-416) for the fuse holders.

The applicant states, in a letter dated August 27, 2005, that it performed a review of fuse holders in the plant that are not inside active equipment. From this review, it was determined that PNP has 36 fuses installed in junction boxes. From this population, it was determined that 12 bolted fuse holders (installed in 1981) are cycled once per refueling outage. The bolted fuse connectors are not susceptible to the relaxation or fatigue that is experienced by fuse clips. The other 24 fuses that have clips are not cycled with any frequency. In conclusion, the fuses with clips, of the fuse holders subject to an AMR, are not routinely removed for maintenance and/or surveillance. Therefore, PNP does not consider fatigue due to mechanical stress to be an aging effect requiring management.

The applicant further states, in the August 27, 2005 letter, that all of the fuse holders are installed in metal junction boxes, which are seismically mounted on their support structure, separate from sources of vibration. Therefore, PNP does not consider vibration to be an applicable aging mechanism.

The applicant also states, in the August 27, 2005 letter, that the junction boxes are located inside rooms that have a controlled environment that protects the panels from the weather and no sources of potential mechanical system leakage are located in proximity to the junction boxes. Therefore, PNP does not consider corrosion to be an applicable aging mechanism.

In addition, the applicant states in the August 27, 2005 letter, that with regard to internal moisture, a review of plant-specific operation experience did not reveal any instance of aging as a result of the formation of condensation internal to the panels. All the junction boxes were inspected and the surface condition of the fuse clips showed no signs of corrosion. Additionally, there was no sign of moisture. Therefore, PNP does not consider corrosion to be an applicable aging mechanism.

In conclusion, the applicant, in the August 27 letter, indicates that it did not find any aging effects (fatigue/ohmic heating, thermal cycling, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation) that require management for in scope fuse holders.

For aging effects of fatigue/ohmic heating, thermal cycling, electrical transients, frequent manipulation, vibration, chemical contamination, corrosion, and oxidation, the project team reviewed the applicant's basis provided above for concluding that these aging effects do not exist at PNP. The project team concludes that no aging management program is needed. Also, based on the project team evaluation of the aging effects addressed by the applicant, the project team concludes that the applicant has addressed the aging effects of fuse holders as identified in ISG-5.

On the basis of its review of current industry research and operating experience, the project team finds that air indoor/adverse localized environment on copper and aluminum will not result in aging that will be of concern during the period of extended operation. The applicant has adequately addressed why aging effects of metallic portions of fuse holders as identified in ISG-5 are not applicable at PNP. Therefore, the project team concludes that there are no applicable aging effects requiring management for metallic portions of fuse holder components exposed to air indoor or adverse localized environments.

<u>Non-Segregated Phase Bus and Connections</u>

In PNP LRA Table 3.6.2-1, the applicant identified AMR results line-items where no aging management programs were identified as a result of the aging review process even though aging effects were identified. The applicant identified various metals and porcelain are the materials of construction of the non-segregated phase bus and connections. The environment includes adverse localized environment caused by heat, radiation, or moisture in the presence of oxygen. The aging effects associated with this commodity is oxidation, loosening of bolted connections due to thermal cycling and corrosion due to moisture. The applicant will manage the aging effects of non-segregated phase bus commodity using PNP AMP B2.1.12, "Non-EQ Electrical Commodities Condition Monitoring Program."

During the audit and review, the project team observed that bus/connections, insulation/insulators, and enclosure assembly are the structure and components of metal enclosed bus. The material for this bus is various metals, porcelain, xenon, and thermo-plastic organic polymers. The environment of metal enclosed bus is air-indoor and outdoor. Aging effects requiring management include embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance, loss of material/general corrosion, loosening of bolted connections/thermal cycling and ohmic heating, hardening and loss of strength/elastomer degradation. The project team requested that the applicant provide appropriate material, environment, aging effects and the aging management program for each structure/component of metal enclosed bus. In a letter dated August 27, 2005, the applicant states that the aging effects (embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance, loss of material/general corrosion, loosening of bolted connections/thermal cycling and ohmic heating, hardening and loss of strength/elastomer degradation), material (various metals, porcelain, and glass. The applicant states that PNP does not have xenon or thermo-plastic organic polymers) and environment (air-indoor and outdoor) will be added to PNP LRA Table 3.6.2-1 (Page 3-416) for the non-segregated phase bus and connections. Below the component type non-segregated phase bus and connections, add the following: bus/connections, insulation/insulators, and enclosure assembly.

Based on the review of the applicant's response, the project team finds it acceptable because the applicant identifies all materials and aging effects associated with metal enclosed bus.

In PNP LRA Table 3.6.2-1, the applicant proposes to manage embrittlement, cracking, melting, discoloration, swelling, or lost of dielectric strength leading to reduced insulation resistance, loss of material/general corrosion, loosening of bolted connections due to thermal cycling and ohmic heating of various metals, porcelain, glass for non-segregated phase bus and connections exposed to air-indoor and outdoor environments using PNP AMP B2.1.12, "Non-EQ Electrical Commodities Condition Monitoring Program."

The project team reviewed the applicant's Non-EQ Electrical Commodities Condition Monitoring Program and its evaluation is documented in Section 2.10 of this audit and review report. The Non-EQ Electrical Commodities Monitoring Program is a new program that manages aging in selected non-EQ commodity groups within the scope of 10 CFR 54. Program activities are responsive to the staff guidance provided in the GALL Report and industry standards. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of embrittlement, cracking, melting, discoloration, swelling, or lost of dielectric strength leading to reduced insulation resistance, loss of material/general corrosion, loosening of bolted connections due to thermal cycling and ohmic heating of various metals, porcelain, glass material exposed to air-indoor and outdoor environments are effectively managed using Non-EQ Electrical Commodities Condition Monitoring program. On this basis, the project team finds that management of the aging effects identified above is acceptable.

High-Voltage Transmission Conductors

In PNP LRA Table 3.6.2-1, the applicant identified AMR results line-items where no aging management programs were identified as a result of the aging review process even though aging effects were identified. Specifically, instances in which the applicant states that no aging effects were identified occurred when components fabricated from aluminum and steel material exposed to atmosphere and weather environments. The applicant identified loss of conductor strength and vibration are the aging effects associated with high voltage transmission. However, the applicant states in the PNP LRA that no AMP is required.

During the audit and review, the project team observed that the most prevalent mechanism contributing to loss of high voltage transmission conductor strength is corrosion which includes corrosion of steel core and aluminum strand pitting. The other aging effects include loss of material/wind induced abrasion and fatigue, increased resistance of connection/oxidation or loss of preload. During the audit and review, the project team requested that the applicant provide an explanation as to why transmission conductors do not require an AMP. The applicant has identified on Page B-95 of the PNP LRA, that routine switchyard inspection detects loose connections in the switchyard. It appears that it has a plant procedure to manage the loose connections. However, this procedure is not credited with managing the aging effects for high voltage connections. The project team requested that the applicant explain why this AMP is not credited with managing the aging effects for high voltage connections.

In a letter dated August 27, 2005, the applicant states that the component type will be changed to high-voltage transmission conductors and connections and the aging effects (loss of material/wind induced abrasion and fatigue, loss of conductor strength/corrosion, increased resistance of connection/oxidation or loss of preload) will be added to PNP LRA Table 3.6.2-1 for the high voltage transmission conductors. The plant experience documented on Page B-95 of the PNP LRA was based on the fact that there was one corrective action document (CAP009228) that documented a site-specific experience. Note: there was no other site-specific experience to document any other problems with high-voltage connections in the basis document, LR-AMPBD-17-NONEQELECCOM, "Non-EQ Electrical Commodities Condition Monitoring Program." The corrective action document (CAP009228), with a time of discovery of August 7, 2001, noted that there was a loose connection in the switchyard disconnect for 29R8 on the east side of the Z phase. A review of the work order history, for disconnect 29R8, determined that the contact on the east side of the Z phase for 29R8 was worked on March 31, 2001, per work order 24110867. Therefore, the problem noted was due to poor workmanship from the work performed by work order 24110867 and not due to any aging mechanisms.

The applicant also states, in the August 27, 2005 letter, that PNP transmission conductor component type includes transmission conductors and the hardware used to secure the conductors to the insulators. The materials for aluminum cable-steel reinforced (ACSR) transmission conductors are aluminum and steel, and the environment is outdoor weather. Based on industry guidance, potential aging effects and aging mechanisms are loss of conductor strength due to general corrosion (atmospheric oxidation of metals) and loss of material due to wear from wind loading. Corrosion in ACSR conductors is a very slow acting mechanism. Corrosion rates are dependent on air quality. PNP is located in a mostly agricultural area with no significant nearby industries that could contribute to corrosive air quality. Corrosion testing of transmission conductors at Ontario Hydroelectric showed a 30% loss of composite conductor strength of an 80-year-old ACSR conductor. The Institute of Electrical and Electronic Engineers National Electrical Safety Code (NESC) requires that tension on installed conductors be a maximum of 60% of the ultimate conductor strength. Therefore, assuming a 30% loss of strength, there would still be a significant margin between what is required by the NESC and the actual conductor strength. In determining actual conductor tension, the NESC considers various loads imposed by ice, wind, and temperature as well as length of conductor span. The transmission conductors in scope for license renewal are short spans located within the high voltage switchyard. The PNP line near the plant is designed for heavy loading; therefore, the Ontario Hydroelectric heavy loading zone study is aligned with respect to loads imposed by weather conditions. The Ontario Hydroelectric test envelops the conductors at PNP, demonstrating that the material loss on the PNP ACSR transmission conductors is acceptable for the period of extended operation. This illustrates with reasonable assurance that transmission conductors at PNP will have ample strength to perform their intended function throughout the renewal term; therefore, loss of conductor strength due to corrosion of the transmission conductors is not an aging effect requiring management.

The applicant also states that loss of material due to mechanical wear can be an aging effect for strain and suspension insulators that are subject to movement. Experience has shown that transmission conductors do not normally swing and that when they do swing because of substantial wind, they do not continue to swing for very long once the wind has subsided. Wear has not been identified during routine inspection. Therefore, loss of material due to wear is not an aging effect requiring management for transmission conductors.

The applicant further states in the August 27, 2005 letter that it also reviewed industry operating experience and NRC generic communications related to the aging of transmission conductors in order to ensure that no additional aging effects exist beyond those identified above. In addition, it reviewed plant-specific operating experience, including nonconformance reports, licensee event reports, and condition reports, and documented interviews with transmission engineering personnel. PNP's review did not identify unique aging effects for transmission conductors beyond those identified above. In conclusion, no aging management program is required for the PNP transmission conductors and connections aging effects of loss of conductor strength and loss of material (mechanical wear).

For the aging effects of loss of conductor strength and vibration, the project team reviewed the applicant's basis provided above for concluding that these aging effects do not exist at PNP. The project team concludes that no aging management program is needed.

On the basis of its review of current industry research and operating experience, the project team finds that atmosphere and weather environments on aluminum and steel will not result in significant aging that will be of concern during the period of extended operation. The applicant has adequately addressed why aging effects of loss of material/wind induced abrasion and fatigue, increased resistance of connection/oxidation or loss of preload are not significant at PNP. Therefore, the project team concludes that there are no aging effects requiring management for high-voltage transmission conductor and connection components exposed to atmosphere and weather environments.

<u>High Voltage Switchyard Bus and Connections</u>

In PNP LRA Table 3.6.2-1, the applicant identified AMR results line-items where no aging management programs were identified as a result of the aging review process even though aging effects were identified. Specifically, instances in which the applicant states that no aging effects were identified occurred when components fabricated from aluminum, stainless steel (bolting) and copper material exposed to atmosphere and weather environments. The applicant identified connection surface oxidation and vibration are the aging effects associated with high-voltage switchyard bus and connections. However, the applicant states that no AMP is required.

The project team noted that the applicant has identified on Page B-95 of the PNP LRA that routine switchyard inspections detect loose connections in the switchyard. It appears that the applicant has a plant procedure to manage the loose connections of switchyard bus. The project team requested that the applicant explain why this procedure is not credited with managing the aging effects for high voltage connections. In a letter dated August 27, 2005, the applicant states that the plant experience documented on Page B-95 of the PNP LRA was based on the fact that there was one corrective action document (CAP009228) that documented a site-specific experience and there was no other site-specific experience to document any other problems with high-voltage connections in the basis document, LR-AMPBD-17-NONEQELECCOM (Non-EQ Electrical Commodities Condition Monitoring Program). This document, with a time of discovery of August 7, 2001, noted that there was a loose connection in the switchyard disconnect for 29R8 on the east side of the Z phase. A review of the work order history, for disconnect 29R8, determined that the contact on the east side of the Z phase for 29R8 was worked on March 31, 2001, per work order 24110867. Therefore, the problem noted was due to poor workmanship from the work performed by work order 24110867 and not due to any aging mechanisms.

As stated in PNP LRA Table 3.6.2-1, the switchyard bus and connections subject to an AMR (1) are constructed of aluminum, copper, and stainless steel (bolting), (2) are exposed to an atmosphere/weather (same as Air-Outdoor) environment consisting of temperatures up to 40°C (105°F), precipitation, and negligible radiation, (3) provide electrical connections to specific sections of an electrical circuit to deliver voltage, current or signals, and (4) require no AMP. There are no aging effects from the outdoor environment (consisting of temperatures up to 40°C (105°F) and precipitation) that would cause the loss of the capability to provide electrical connections to specified sections of an electrical circuit to deliver voltage, current, or signals.

In conclusion, the applicant states in the August 27 letter that it determined that an environment consisting of temperatures up to 40°C (105°F) and precipitation has no significant aging effect on aluminum, copper, and stainless steel from the component parts from which the switchyard bus and connections are constructed. Therefore, no AMP is required for high-voltage switchyard bus and connections.

Based on the project team's review of the applicant's response in the August 25, 2005 letter, the project team concludes that the site-specific experience was the result of poor workmanship and not related to aging mechanisms. Also, for the aging effects of connection surface oxidation and vibration. The project team reviewed the applicant's basis provided above for concluding that these aging effects do not exist at PNP. The project team concludes that no aging management program is needed.

On the basis of its review of current industry research and operating experience, the project team finds that atmosphere and weather environments on aluminum, stainless steel, and copper will not result in significant aging that will be of concern during the period of extended operation. Therefore, the project team concludes that there are no aging effects requiring management for high-voltage switchyard bus and connections exposed to atmosphere and weather environments.

<u>High-Voltage Insulators</u>

In PNP LRA Table 3.6.2-1, the applicant identified AMR results line-items where no aging management programs were identified as a result of the aging review process even though aging effects were identified. Specifically, instances in which the applicant states that no aging effects were identified occurred when components fabricated from porcelain, cement, and metal material exposed to atmosphere and weather environments. The applicant identified surface contamination and cracking are the aging effects associated with high-voltage insulators. However, the applicant states that no AMP is required.

During the audit and review, the project team noted that various airborne materials such as dust, salt and industrial effluents can contaminate insulator surfaces. A large buildup of contamination enables the conductor voltage to track along the surface more easily and can lead to insulator flashover. Surface contamination can be a problem in areas where there are greater concentrations of airborne particles such as near facilities that discharge soot or near the seacoast where salt spray is prevalent. Cracks have been known to occur with insulators when the cement that binds the parts together expands enough to crack the porcelain. Mechanical wear is another aging effect for strain and suspension insulators in that they are subject to movement. Movement of insulators can be caused by wind blowing the supported transmission conductor, causing it to swing from side to side. If this swinging is frequent enough, it could cause wear in the metal contact points of the insulator string and between an insulator and the supporting hardware. The project team requested that the applicant identify all aging effects associated with high voltage insulators and explain why no AMP is required. In a letter dated August 27, 2005, the applicant states that the aging effects (loss of material/mechanical wear due to wind blowing on transmission conductors) will be added to PNP LRA Table 3.6.2-1 (Page 3-417) for the high-voltage insulator. As stated in PNP LRA Table 3.6.2-1, high-voltage insulators (including high voltage strain and suspension insulators), that perform the function of insulating and supporting electrical transmission conductors and are subject to an AMR, (1) are constructed of porcelain, galvanized metal, and cement, (2) are exposed to an outdoor weather environment consisting of temperatures up to 40°C (105°F), precipitation, and negligible radiation, (3) insulate and support an electrical conductor, and (4) require no AMP. PNP did not identify any aging effects from the outside environment (consisting of temperatures up to 40°C (105°F) and precipitation) that would cause the loss of the capability to insulate or support its associated electrical conductor.

The applicant also states in the August 27, 2005 letter that regarding the potential for contamination of insulators, the buildup of surface contamination is gradual and in most areas such contamination is washed away by rain; the glazed insulator surface aids this contamination removal. A large buildup of contamination enables the conductor voltage to track along the surface more easily and can lead to insulator flashover. Surface contamination can be a problem in areas where there are greater concentrations of airborne particles such as near facilities that discharge soot or near the seacoast where salt spray is prevalent. PNP is located in an area with moderate rainfall where airborne particle concentrations are comparatively low; consequently, the rate of contamination buildup on the insulators is not significant. At PNP, as in most areas of the Michigan transmission system, contamination build-up on insulators is not a problem due to rainfall periodically “washing” the insulators. Additionally, there is no nearby heavy industry or other producers of industrial effluents, which could cause excessive contamination. There is no salt spray at PNP as the plant is far from any ocean. Therefore, surface contamination is not an applicable aging effect for the insulators in the service conditions they are exposed to at PNP.

Furthermore, the applicant also states in the August 27, 2005 letter that regarding high voltage porcelain insulator cracking, porcelain is essentially a hardened, opaque glass. As with any glass, if subjected to enough force it will crack or break. The most common cause for cracking or breaking of an insulator is being struck by an object (e.g., a rock or bullet). Cracking and breaking caused by physical damage is not an aging effect and is not subject to an AMR. Cracks have been known to occur with insulators when the cement that binds the parts together expands enough to crack the porcelain. This phenomenon, known as cement growth, occurs mainly because of improper manufacturing processes or materials, which make the cement more susceptible to moisture penetration, and the specific design and application of the insulator. The string insulators susceptible to porcelain cracking caused by cement growth are isolated to bad batches (specific, known brands and manufacture dates) of string insulators used in strain application. The post insulators most susceptible to this aging effect are multi-cone (post) insulators used in cantilever applications. Research of corrective action documents within the PNP database revealed no instance of insulator cracking or failure related to cement growth at the PNP switchyard. Accordingly, cracking due to cement growth is not an applicable aging effect for the high voltage insulators in the service conditions they are exposed to at PNP.

Also, the applicant states in the August 27, 2005 letter that regarding mechanical wear, this is an aging effect for strain and suspension insulators in that they are subject to movement. Movement of the insulators can be caused by wind blowing the supported transmission conductor, causing it to swing from side to side. If this swinging is frequent enough, it could cause wear in the metal contact points of the insulator string and between an insulator and the supporting hardware. Although this mechanism is possible, experience has shown that the transmission conductors do not normally swing and that when they do, due to a substantial wind, do not continue to swing for very long once the wind has subsided. Wind loading that can cause a transmission line and insulators to vibrate or sway is considered in the design and installation. The loss of material due to wear concern will not cause a loss of intended function of the insulators at PNP; therefore, loss of material due to wear is not an applicable aging effect for insulators.

Lastly, in the August 27, 2005 letter, the applicant states that PNP reviewed their operating experience to validate aging effects for switchyard insulators. This review included corrective action documents for any documented instances of switchyard insulator aging, in addition to interviews with PNP engineering and maintenance personnel. No instance of aging related problems within the scope of license renewal switchyard insulators due to contaminants, cracking, cement growth, or mechanical wear was uncovered.

For the aging effects of surface contamination, cracking, and mechanical wear, the project team reviewed the applicant's basis provided above for concluding that these aging effects to not exist at PNP. The project team concludes that no aging management program is needed.

On the basis of its review of current industry research and operating experience, the project team finds that atmosphere and weather environments on porcelain, cement, and metal will not result in significant aging that will be of concern during the period of extended operation. The applicant has adequately addressed why aging effects of loss of material/mechanical wear, surface contamination, and cracking are not applicable aging effects at PNP. Therefore, the project team concludes that there are no aging effects requiring management for high-voltage insulator components exposed to atmosphere and weather environments.

<u>Cable Connections (Metallic Portions)</u>

In PNP LRA Table 3.6.2-1, the applicant did not address the aging effects of metallic cable connections. The aging effects of metallic cable connections include loosening of bolted connections due to thermal cycling, ohmic heating, electrical transient, vibrations, chemical contamination, corrosion and oxidation. The environment includes air-indoor and outdoor. The project team requested that the applicant identify environment and aging effects of cable connections and provide an AMP or justify why an AMP is not required for metallic cable connections. In a letter dated August 27, 2005, the applicant states that the material (various metals used for electrical contacts), environment (air-indoor and outdoor) and aging effects (include loosening of bolted connections due to thermal cycling, ohmic heating, electrical transient, vibrations, chemical contamination, corrosion and oxidation) will be added to PNP LRA Table 3.6.2-1 (Page 3-414) for the electrical cables and connections not subject to 10 CFR 50.49 EQ. The applicant will also add the following to PNP AMP B2.1.12, "Non-EQ Electrical Commodities Condition Monitoring Program" (provided by the applicant in the August 25, 2005 letter):

> Parameters Monitored/Inspected: This program will focus on the metallic parts of the connection. The monitoring includes loosening of bolted connections due to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation. A representative sample of electrical cable connections is tested. The following factors are considered for sampling: application (high, medium and low voltage), circuit loading, and location (high temperature, high humidity, vibration, etc.). The technical basis for the sample selected is to be documented.
>
> Detection of Aging Effects: Electrical connections within the scope of license renewal are tested at least once every 10 years. Testing may include thermography, contact resistance testing, or other appropriate testing methods justified in the application. This test frequency is adequate to preclude failures of the electrical connections since experience has shown that aging degradation of electrical connections is a slow process. A 10-year testing frequency will provide two data points during a 20-year period, which can be used to characterize the degradation rate. The first tests for license renewal are to be completed before the period of extended operation.
>
> Acceptance Criteria: The acceptance criteria for each connection test are defined by the specific type of test performed and the specific type of cable connections tested.
>
> Corrective Actions: Pursuant to 10 CFR Part 50, Appendix B, an engineering evaluation is performed when the test acceptance criteria are not met in order to ensure that the intended functions of the cable connections can be maintained consistent with the current licensing basis. Such an evaluation is to consider the significance of the test results, the operability of the component, the reportability of the event, the extent of the concern, the potential root causes for not meeting the test acceptance criteria, the corrective action warranted, and the likelihood of recurrence. When an unacceptable condition or situation is identified, a determination is made on whether the same condition or situation is applicable to other within the scope of license renewal cable connections not tested. As discussed in the appendix to the GALL Report, Volume 2, the project team finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address corrective actions.

The project team reviewed the applicant's Non-EQ Electrical Commodities Condition Monitoring Program and its evaluation is documented in Section 2.10 of this audit and review report. The Non-EQ Electrical Commodities Monitoring Program is a new program that manages aging in selected non-EQ commodity groups within the scope of 10 CFR 54. Program activities are responsive to the staff guidance provided in the GALL Report and industry standards. On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of loosening of bolted connection due to thermal cycling, ohmic heating, electrical transient, vibrations, chemical contamination, corrosion and oxidation of various metals used in cable connections exposed to air-indoor and outdoor environments are effectively managed using the Non-EQ Electrical Commodities Condition Monitoring Program.

On this basis, the project team finds that management of the aging effects identified above is acceptable.

Conclusion

On the basis of its review, the project team finds 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 finds 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).

Attachment 1

Abbreviations and Acronyms

10 CFR Part 54	Title 10 of the Code of Federal Regulations, Part 54
ACSR	aluminum cable-steel reinforced
ADAMS	Agencywide Documents Access and Management System
AFW	auxiliary feedwater
AMP	aging management program
AMR	aging management review
ASTM	American Society for Testing Materials
B&W	Babcock and Wilcox
CAP	corrective action program
CASS	cast austenitic stainless steel
CCS	component cooling water system
CE	Combustion Engineering
CFR	Code of Federal Regulations
CLB	current licensing basis
CRD	control rod drive
CRDM	control rod drive mechanism
CUF	cumulative usage factor
CWS	circulating water system
DBA	design basis accident
DE	Division of Engineering
DIPM	Division of Inspection Program Management
DOR	Division of Operating Reactors
ECT	eddy current testing
EDG	emergency diesel generator
EEQ	electrical equipment qualification
EPRI	Electric Power Research Institute
EQ	environmental qualification
FAC	flow-accelerated corrosion
FPPR	Fire Protection Program Report
FSAR	Final Safety Analysis Report
GALL	Generic Aging Lessons Learned
HELB	high energy line breaks
HSS	high safety significance

IASCC	irradiation assisted stress corrosion cracking
IGA	intergranular attack
IN	Information Notice
IR	insulation resistance
ISG	Interim Staff Guidance
ISI	in-service inspections
ISL	Information Systems Laboratories, Inc.
ITG	Issues Task Group
LOCA	loss of coolant accident
LRA	license renewal application
MEAP	material, environment, aging effect and program
MELB	moderate energy line break
MIC	microbiologically influenced corrosion
MRP	EPRI Materials Reliability Program
MRV	minimum required values
MSIP	Mechanical Stress Improvement Process
NDE	non-destructive evaluation
NEI	Nuclear Energy Institute
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NMC	Nuclear Management Company
NPDES	National Pollutant Discharge Elimination System
NPS	nominal pipe size
NRC	U.S. Nuclear Regulatory Commission
NRR	Office of Nuclear Reactor Regulation
ODSCC	outer diameter stress corrosion cracking
OEP	operating experience program
PCP	primary coolant pump
PCS	primary coolant system
PDI	performance demonstration initiative
PNP	Palisades Nuclear Plant
PORV	power-operated relief valve
PWR	pressurized water reactor
PWSCC	primary water stress corrosion cracking
RAI	request for additional information
RG	Regulatory Guide
RLEP-B	License Renewal and Environmental Impacts Program, Section B
RPV	reactor pressure vessel
RT	radiographic testing
RTD	resistance temperature detectors
RVI	reactor vessel internals

SCs	structures and components
SCC	stress corrosion cracking
SCS	shield cooling system
SER	safety evaluation report
SFP	spent fuel pool
SG	steam generator
SIRWT	safety injection and refueling water tank
SRP-LR	Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants
SSCs	systems, structures, and components
SWS	service water system
TDR	time domain reflectometry
TLAA	time-limited aging analysis
TS	technical specifications
UT	ultrasonic testing
VT	visual examination

Attachment 2

Project Team and Applicant Personnel

PNP LRA Audit and Review Project Team

Kurt Cozens, NRC, Team Leader*
Robert Hsu, NRC, Backup Team
Mike Kennedy, ISL, ISL Lead
Farideh Saba, ISL
Malcolm Patterson, ISL
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Project Team Support

Jacob Zimmerman, Chief, NRC RLEP Section B*
Mike Morgan, NRC RLEP Project Manager*
Juan Ayala, NRC RLEP Assistant Project Manager
Colleen Amoruso, ISL administrative support
Tammy Pfiester, ISL administrative support
Karen King, ISL, Onsite administrative support

Applicant Personnel Contacted

Darrel Turner	Tom Newton
Robert Vincent	George Schrader
William Roberts	Mike Acker
Mark Cimock	Craig Fritts
Larry Seamans	Ken Housch
John Kneeland	Alan Lyon
William Bryant	Brian Shaler
Pete Wolfinger	Joel McElrath
John Hager	Stan Pierce

Applicant Personnel Who Attended the Public Exit Meeting on September 2, 2005

Mark Savage	John Kneeland
Darrel Turner	Mark Cimock
Miles Rail	Steve Wawro
Dan Lemon	Robert Vincent
Bill Bryant	Larry Seamans
Jim Roberts	Douglas Johnson

*Attended the Public Exit Meeting on September 2, 2005.

Members of the Public Who Attended the Public Exit Meeting on September 2, 2005

Corinne Carey
Kenneth Richards
LeRoy Wolins
Srbastiaro Picciuca
Jean McFadden
Kathryn Barnes
Chuck Jordon

Attachment 3
Element of an Aging Management Program for License Renewal

No.	Element Name	Description
1	Scope of program	Scope of program should include the specific structures and components subject to an AMR for license renewal.
2	Preventive actions	Preventive actions should prevent or mitigate aging degradation.
3	Parameters monitored or inspected	Parameters monitored or inspected should be linked to the degradation of the particular structure or component intended function(s).
4	Detection of aging effects	Detection of aging effects should occur before there is a loss of structure or component intended function(s). This includes aspects such as method or technique (i.e., visual, volumetric, surface inspection), frequency, sample size, data collection and timing of new/one-time inspections to ensure timely detection of aging effects.
5	Monitoring and trending	Monitoring and trending should provide predictability of the extent of degradation, and timely corrective or mitigative actions.
6	Acceptance criteria	Acceptance criteria, against which the need for corrective action will be evaluated, should ensure that the structure or component intended function(s) are maintained under all CLB design conditions during the period of extended operation.
7	Corrective actions	Corrective actions, including root cause determination and prevention of recurrence, should be timely.
8	Confirmation process	Confirmation process should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective.
9	Administrative controls	Administrative controls should provide a formal review and approval process.
10	Operating experience	Operating experience of the aging management program, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support the conclusion that the effects of aging will be managed adequately so that the structure and component intended function(s) will be maintained during the period of extended operation.

Attachment 4

Disposition of Requests for Additional Information, LRA Supplements, and Followup Items

Requests for Additional Information

RAI Number	Audit and Review Report Section	Description
RAI-B2.1.2-1	2.2.2	Please define the ASME Code Edition for Inservice Inspection (ISI) Program B2.1.2.
RAI-B2.1.5-1	2.3.2	Please identify the inspection frequency for the buried piping aging management program B2.1.5.
RAI-3.1.2-1	2.11.2	AMPs that note “one-time inspections” should identify an acceptable form of inspection method for various types of situations. The PNP LRA does not identify any specific methods of inspection. The PNP LRA simply provides a general statement that examination techniques will be visual, volumetric, or other appropriately established NDE methods. Please identify the inspection methods for each “one time inspection” listed.
RAI-3.1.2-1(a)	3.1.1.5	The project team requested that the applicant clarify the nature of the pressurizer quench tank interior environment and justify the application of its System Monitoring Program and One-Time Inspection Program to manage loss of material for these environments.
RAI-3.1.2.2.2-1	3.1.2.2.1	The PNP LRA states that an augmented inspection for steam generator shell assemblies for loss of material due to pitting/crevice corrosion is not applicable for PNP. NUREG-1801, “Generic Aging Lessons Learned (GALL) Report” recommends such augmented inspection based on industry experience and extended exposure of the shell material to the water environment. Please provide technical justification for the determination.

RAI Number	Audit and Review Report Section	Description
RAI-3.1.2.2.7.2-1	3.1.2.7.1	The AMP for cast austenitic stainless steel (CASS) thermal embrittlement in the PNP LRA does not include a flaw tolerance evaluation or enhanced volumetric inspection as recommended in the GALL Report. Please clarify and discuss this basis.
RAI-3.2.1-1	3.2	The Flow Assisted Corrosion (FAC) Program is not listed as an AMP in PNP LRA Sections 3.2.1 and 3.2.3. Such a program is typically necessary to manage the effects of FAC for license renewal. Please verify whether the intent is to credit this AMP, B2.1.1 1, in these sections.
RAI-3.6.2-1	3.6	In the notes area for Table 3.6.2-1 (and in other notes for other tables) various components are described; however, they are not specified in the associated table. For example, are neutron monitoring cables and uninsulated ground connectors within the scope of license renewal? Where are they located in the associated PNP LRA tables?

PNP LRA Supplements

By letter dated August 25, 2005 (ML052410206), the applicant submitted an LRA supplement in response to on-site audits of the aging management programs and 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.

By letter dated August 27, 2005 (ML052440392), the applicant submitted an additional LRA supplement in response to on-site audits of the aging management programs and 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.

PNP LRA Revisions

By letter dated May 5, 2005 (ML0513202350), the applicant submitted additional information, resulting from an internal applicant review, which revised the LRA.

By letter dated July 1, 2005 (ML051960390), the applicant submitted responses to RAIs which revised the LRA.

By letter dated September 2, 2005 (ML052500207), the applicant submitted responses to project team questions which revised the LRA.

By letter dated September 16, 2005 (ML052650369), the applicant submitted responses to RAIs which revised the LRA.

Confirmatory Item	**Audit and Review Report Section**	**Description**
CI-2.4.2-1	2.4.2	During the audit and review, the applicant stated that the version of EPRI TR-107396 used for its Closed Cycle Cooling Water Program is Revision 1, which is not consistent with GALL AMP XI.M21.
CI-2.17.2-1	2.17.2	PNP AMP B2.1.21 is based on guidelines in EPRI TR-105714, Revision 5 for primary water chemistry, and TR-102134, Revision 5 for secondary water chemistry. The GALL AMP XI.M2 states that water chemistry control is in accordance with the guidelines in EPRI TR-105714, Revision 3 for primary water chemistry in PWRs; EPRI TR-102134, Revision 3, for secondary water chemistry in PWRs; or later revisions or updates of these reports as approved by the staff.
CI-3.1.1-1	3.1.1.1, 3.1.1.3	The applicant states that thermal sleeves do not serve an intended function and therefore do not require aging management. The applicant has agreed to remove thermal sleeves from the scope of license renewal.

Open Item	**Audit and Review Report Section**	**Description**
OI-2.2.2-1	2.2.2, 2.14.2	The applicant will revise its ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program descriptions in PNP LRA Appendices A and B to reflect that the applicant uses the 2001 Edition including the 2002 and 2003 Addenda of ASME Section XI. The revised program descriptions will identify exceptions to this code taken by the applicant, if any, that impact aging management effectiveness.

Open Item	Audit and Review Report Section	Description
OI-2.5.2-1	2.5.2	The PNP Containment Inservice Inspection Program references the ASME 1998 Edition, no addenda, for Section XI, Subsections IWE and IWL, except that the personnel qualification process is based on the 1992 Edition through 1992 Addendum. PNP will revise its Containment Inservice Inspection Program description in the PNP LRA to identify use of the 1998 Edition as an exception to the GALL Report.
OI-3.3.1-1	3.3.1.6, 3.3.3.5	During the audit and review, the applicant was asked to explain how the One-Time Inspection Program is used in lieu of GALL AMP XI.M24 for managing loss of material of components in the compressed air system. In a letter dated August 27, 2005, the applicant states that it will develop a Compressed Air Monitoring Program.

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 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 Aging Management Program**	**PNP LRA-AMP Basis Document and Other Documents Reviewed**
Alloy 600 Program (AMP B2.1.1)	Nickel-Alloy Nozzles and Penetrations, XI.M11	PNP Technical Report, LR-AMPBD-01, "Alloy 600 Program," Revision 2, 2/28/2005 Palisades Plant 15 and 60-Day Responses to NRC Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity," (dated 4/3/2002 and 5/16/02, with 15-day Response Supplemental Information dated 6/25/2003) NRC Bulletin 2002-02, "Reactor Pressure Vessel Head and Vessel Head Penetration Nozzle Inspection Programs," 8/9/2002 Palisades Plant 15-Day Response to NRC Bulletin 2002-02, "Reactor Pressure Vessel Head and Vessel Head Penetration Nozzle Inspection Programs," 8/26/2002 Palisades Plant Response to Order EA-03-009, "Issuance of Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," 3/3/2003 Palisades Plant Response to Order EA-03-009, "Order Establishing Interim Inspection Requirements for Reactor Pressure Vessel Heads at Pressurized Water Reactors," for Palisades 2003 Refueling Outage, 5/22/2003

Applicant's Aging Management Program	GALL Aging Management Program	PNP LRA-AMP Basis Document and Other Documents Reviewed
		Engineering Manual Procedure EM-09-13, "Inservice Inspection Pressure Testing Program/Boric Acid Corrosion Control Program," Revision 6, 10/29/2003 Palisades Plant 60-Day Response to Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity," Request for Additional Information (TAC No. MB4562), 1/20/2003 Palisades Plant "60-Day Report Per First Revised Order EA-03-009" - Fall 2004 refueling outage reactor pressure vessel head visual inspection and NDE of head penetrations, 1/13/2005 Palisades Plant "60-Day Response to Bulletin 2004-01, 'Inspection of Alloy 82/182/600 Materials Used in the Fabrication of Pressurizer Penetrations and Steam Space Piping Connections at Pressurized-Water Reactors,'" 7/26/2004
ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program (AMP B2.1.2)	ASME Section XI Inservice Inspection, Subsections IWB, IWC & IWD, XI.M1; Reactor Head Closure Studs, XI.M3; ASME Section XI, Subsection IWF, XI.S3	PNP Technical Report, LR-AMPBD-02, "ASMEISI, ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program," Revision 2, 2/28/2005 NRC letter to Palisades Nuclear Plant, "Palisades Plant - Risk-Informed Inservice Inspection Program (TAC NO. MB4420)," 5/19/2003 PNP Engineering Manual Procedure, EM-09-03, "Inservice Inspection," Revision 13, 2/5/2003 PNP Engineering Manual Procedure, EM-09-13, "Inservice Inspection Pressure Testing Program/Boric Acid Corrosion Control Program," Revision 6, 10/29/2003

Applicant's Aging Management Program	GALL Aging Management Program	PNP LRA-AMP Basis Document and Other Documents Reviewed
		NRC Safety Evaluation Report, "Palisades Plant - Risk-Informed Inservice Inspection Program (TAC No. MB4420)," 5/19/2003
Buried Services Corrosion Monitoring Program (AMP B2.1.5)	Buried Piping and Tanks Inspection, XI.M34	PNP Technical Report, LR-AMPBD-05-BURIEDSVC, "Buried Services Corrosion Monitoring Program," Revision 1, 12/1/2004 NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," 7/2001 10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants" Peabody Associates PCPC-2000-1, "Assessment of Underground Systems, Structures and Components," Revision "Draft," 6/15/2000 PNP Technical Report, LR-AMPBD-13-FIREPROT, "Fire Protection Program," Revision 3, 3/7/2005
Closed Cycle Cooling Water Program (AMP B2.1.6)	Closed-Cycle Cooling Water System, XI.M21	PNP Technical Report, LR-AMPBD-06-CCCW, "Closed Cycle Cooling Water Program," Revision 2, 2/28/2005 PNP Procedure COP-16A, "Component Cooling Water System Chemistry," Revision 12, 10/31/2002 PNP Procedure COP-22, "Diesel Generator Cooling Water Chemistry," Revision 8, 3/15/2001 EM-09-16, "Heat Exchanger Condition Assessment Program," Revision 3, 1/31/2003 "Master Heat Exchanger Testing Plan," Revision 2, 6/30/2003 EM-09-04, "Inservice Testing of Selected Safety-Related Pumps," Revision 19, 4/22/2003

Applicant's Aging Management Program	GALL Aging Management Program	PNP LRA-AMP Basis Document and Other Documents Reviewed
Containment Inservice Inspection Program (AMP B2.1.7)	ASME Section XI, Subsection IWE, XI.S1; ASME Section XI, Subsection IWL, XI.S2; Concrete Containment Tendon Prestress, X.S1	PNP Technical Report, LR-AMPBD-08-CONTISI, "Containment Inservice Inspection Program," Revision 2, 2/28/2005 Palisades Nuclear Plant, Engineering Manual EM-09-12, "Containment Structural Integrity Surveillance Program," Revision 4, 6/11/2002 Letter from Consumers Power to NRC, Docket 50-255 License DPR-20, "Follow-Up to Inspection Report 90017 (discusses tendons removed and reinstalled at opening for SG replacement)," 2/12/1991 Letter from NRC Docket No, 50-255, TAC Nos. MB4216 and MB4218, "Palisades Plant - Evaluation of Containment Inservice Inspection Relief Requests," 9/27/2002 Palisades Nuclear Plant, Condition Report CAP006041, "Containment Liner Plate Corrosion Observed During Containment Coatings Walkdown," closed 11/20/1999 Palisades Nuclear Plant, Condition Report CAP031256, "Tendon H-24BD Average Actual Liftoff Value is Unacceptable," closed 2/25/2003 Palisades Nuclear Plant, Condition Report CAP031258, "Water Detected During Inservice Inspection of Tendon D1-38," closed 10/23/2002 Palisades Nuclear Plant, Condition Report CAP032838, "30-Year Tendon Surveillance; Grease Replacement," closed 3/5/2003
Containment Leakage Testing Program (AMP B2.1.8)	10 CFR 50, Appendix J, XI.S4	PNP Technical Report, LR-AMPBD-09-CONTLRT, "Containment Leakage Testing Program," Revision 1, 12/1/2004

Applicant's Aging Management Program	GALL Aging Management Program	PNP LRA-AMP Basis Document and Other Documents Reviewed
		Palisades Nuclear Plant, Engineering Manual EM-09-10, "Palisades ILRT/LLRT Program," Revision 8, 4/27/2005 Palisades Nuclear Plant, Procedure and Basis Document RT-36, "Containment Integrated Leak Rate Test," Revision 16, 4/30/2001 Palisades Nuclear Plant, Procedure No. RT-142, "Containment Inservice Inspection-Metal Liner," Revision 0, 10/14/2002 Palisades Nuclear Plant, Procedure No. FT-7, "Containment Inservice Inspection-Concrete," Revision 1, 6/9/2005 Letter from NRC Docket 50-255, (TAC No. 64339), "Amendment No. 126 to Provisional Operating License No. DPR-20," 6/1/1989 Letter from NRC Docket 50-255, (TAC No. M94528), "Palisades Plant-Issuance of Amendment RE: Containment Emergency Escape Air Lock Testing, and Exemption From Certain Requirements of 10 CFR Part 50, Appendix J," 9/30/1997 Letter from NRC Docket 50-255, (TAC No, MB0855), "Palisades Plant Issuance of Amendment RE: Option B Containment Leak Rate Testing," 3/30/2001
Diesel Fuel Monitoring and Storage Program (AMP B2.1.9)	Fuel Oil Chemistry, XI.M30	PNP Technical Report, LR-AMPBD-10-DSLFUEL, "Diesel Fuel Monitoring And Storage Program," Revision 1, 1/26/2005 PNP Procedure COP-22A, Chemistry Operating Procedure "Diesel Fuel Oil Testing Program," Revision 4, 6/24/2004 MC-17, Technical Specification Surveillance Procedure "Fuel Oil Sampling," Revision 25, 7/23/2003

Applicant's Aging Management Program	GALL Aging Management Program	PNP LRA-AMP Basis Document and Other Documents Reviewed
		CH 3.36, Chemistry Procedure "Water and Sediment Analysis," Revision 3, 7/18/2002 CH 3.37, Chemistry Procedure "Specific Gravity Analysis," Revision 3, 7/19/2002 CH 3.52, Chemistry Procedure "Determination of Particulate Contamination in Fuel Oils," Revision 0, 7/5/2002 ASTM D4057, "Standard Practice for Manual Sampling of Petroleum and Petroleum Products" ASTM D2276, "Standard Test Method for Particulate Contaminant in Middle Distillate Fuel by Laboratory Filtration" (Modified for 3.0 micron sample size) ASTM D2709, "Standard Test Method for Water and Sediment in Distillate Fuels by Centrifuge" ASTM D1796, "Standard Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure)" Corrective Action Document CA001997, "Evaluate the addition of an additive, an oxidizer inhibitor, to stabilize the fuel oil," 11/13/2000 Corrective Action Document CA016984, "Develop an engineering analysis (EA) and supporting 50.59 screen/evaluation," 10/3/2002 Corrective Action Program Document CAP 013180, "Diesel Fuel Oil Tank (10-A) Particulates Above Administrative Limits," 11/17/2000

Applicant's Aging Management Program	GALL Aging Management Program	PNP LRA-AMP Basis Document and Other Documents Reviewed
		Corrective Action Program Document CAP002662, "Remove Particulate, Water and Sediment from Bottom of T-296," 1/29/2001 Purchase Order No. N0829008, Palisades Nuclear Plant to Fleming Brother Oil Co., 12/22/2004
Fire Protection Program (B2.1.10)	Fire Protection, XI.M26; Fire Water System, XI.M27	PNP Technical Report, LR-AMPBD-13-FIREPROT, "Fire Protection Program," Revision 3, 3/7/2005 NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," 7/2001 10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants" Letter from NRC to NEI, "Interim Staff Guidance (ISG)-04: Aging Management of Fire Protection Systems for License Renewal," 12/3/2002 Palisades Nuclear Plant Final Safety Analysis Report, Section 9.6, Fire Protection Palisades Permanent Maintenance Procedure MSM-M-16, "Inspection of Water Tight Barriers," Revision 11, 2/11/2004 Palisades Post-Fire Safe Shutdown Analysis EA-PSSA-00-001, Revision 0 Federal Regulation 10 CFR 50.48 "Fire Protection" Federal Regulation 10 CFR 50 Appendix R, Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979, Sections III G, J, L, and O Safety Evaluation Report Related to the License Renewal of the Dresden Nuclear Power Station, Units 2 and 3 and Quad Cities Nuclear Power Station, Units 1 and 2, 7/2004

Applicant's Aging Management Program	GALL Aging Management Program	PNP LRA-AMP Basis Document and Other Documents Reviewed
		Palisades Fire Hazards Analysis Report (FHA), Revision 4 NRC Fire Protection Safety Evaluation Report, 9/1/1978 NRC Supplement 2 to Fire Protection Safety Evaluation Report, 2/10/1981 NRC Safety Evaluation Report-Review in Accordance With Appendix R Sections III.G and III.L, 5/26/1983 NRC Safety Evaluation Report-Relative to Appendix R Exemptions Requested for Palisades Plant, 7/12/1985 NRC Safety Evaluation Report - Installation of Isolation Switches for Appendix R to 10 CFR 50, 1/29/1986 NRC Safety Evaluation Report - Regarding a Postulated Fire in the Charging Pump Room or Corridor, 12/3/1987 NRC Safety Evaluation Report - Related to Amendment No 122 to Provisional Operating License No DPR-20, 5/19/1989 License Renewal Application Dresden Nuclear Power Station Docket Nos. 50-237 and 50-249 Facility Operating License Nos. DPR-19 and PR-25 Quad Cities Nuclear Power Station Docket Nos. 50-254 and 0-265 Facility Operating License Nos. DPR-29 and DPR-30, 1/2003 Safety Evaluation Report Related to the License Renewal of the Dresden Nuclear Power Station, Units 2 and 3 and Quad Cities Nuclear Power Station, Units 1 and 2, 7/2004 Palisades Procedure FPIP-7, Revision 10, "Fire Prevention Activities"

Applicant's Aging Management Program	GALL Aging Management Program	PNP LRA-AMP Basis Document and Other Documents Reviewed
		Palisades Procedure FPIP-4, "Fire Protection Systems and Fire Protection Equipment," Revision 19, 5/24/2004 Palisades Procedure FPIP-5, Revision 9, "Requirements for Inspection and Testing of Fire Protection Systems and Fire Protection Equipment," Revision 11, 11/1/2000 Nuclear Energy Institute NEI 95-10, "Industry Guideline on Implementing the Requirements of 10CFR Part 54, The License Renewal Rule," Revision 3, 3/2001
Flow Accelerated Corrosion Program (AMP B2.1.11)	Flow-Accelerated Corrosion, XI.M17	PNP Technical Report, LR-AMPBD-15-FAC, "Flow Accelerated Corrosion Program," Revision 1, 12/1/2004 NRC Information Notice 93-21, "Summary of Observations Compiled during Engineering Audits or Inspections of Licensee Erosion/Corrosion Programs" EPRI NSAC-202L-R2, "Recommendation for an Effective Flow-Accelerated Corrosion Program," 4/1999 NRC Information Notice 81-28, "Failure of Rockwell-Edward Main Steam Isolation Valves," 9/3/1981 NRC Bulletin 87-01 "Thinning of Pipe Walls in Nuclear Power Plants," 07-09-1987 Generic Letter 89-08, "Erosion/Corrosion-Induced Pipe Wall Thinning," 5/1989 EM-09-08, "Palisades Flow Accelerated Corrosion (FAC) Program," Revision 11, 3/15/2004 FP-PE-FAC-01 "Flow Accelerated Corrosion Inspection Program" (NMC Fleet), Revision 0, 9/4/2003

Applicant's Aging Management Program	GALL Aging Management Program	PNP LRA-AMP Basis Document and Other Documents Reviewed
		Corporate Directive CD 5.17, "Flow Accelerated Corrosion and Service Water Inspection Program Standard," Revision 1, 8/27/2003 Flow Accelerated Corrosion (FAC) Master Plan NRC Information Notice 92-35, "Higher than Predicted Erosion/Corrosion in Unisolable Reactor Coolant Pressure Boundary Piping Inside Containment at a Boiling Water Reactor," 5/6/1992 NRC Information Notice 95-11, "Failure of Condensate Piping Because of Erosion/Corrosion at a Flow-Straightening Device," 2/24/1995 NRC Information Notice 89-53, "Rupture of Extraction Steam Line on High Pressure Turbine," 6/13/1989 NRC Information Notice 97-84, "Rupture in Extraction Steam Piping as a Result of Flow-Accelerated Corrosion," 12/11/1997 NRC Information Notice 91-18, "High-Energy Piping Failures Caused by Wall Thinning," 3/12/1991 and Supplement 1, 12/18/1991
Non-EQ Electrical Commodities Condition Monitoring Program (AMP B2.1.12)	Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements, XI.E1 Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification	PNP Technical Report, LR-AMPBD-17-NONEQELECOM, "Non-EQ Electrical Commodities Condition Monitoring Program," Revision 2, 2/28/2005 NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," 7/2001 10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants" Palisades Procedure MSE-E-51 "Inspection for Identifying Adverse Localized Environments for Electrical Commodities in

Applicant's Aging Management Program	GALL Aging Management Program	PNP LRA-AMP Basis Document and Other Documents Reviewed
	Requirements Used in Instrumentation Circuits, XI.E2 Inaccessible Medium Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements, XI.E3	Scope of License Renewal" (Plant "Grand Tour") WI-SPS-E-02 "Insulation Resistance Testing of Electrical Equipment" (R1) MSE-E-52 "Periodic Testing of Sensitive Instrumentation Circuits in Scope of License Renewal" MSE-E-53 "Periodic Test for Medium-Voltage Cables in Scope of License Renewal Exposed to Environment Promoting the Growth of Water Trees" MSE-E-54 "Periodic Inspection of Water Levels in Manholes MH#1, MH#2 & MH#3 to Minimize the Growth of Water Trees in Medium-Voltage Cables in Scope of License Renewal" EPRI TR-103834-P1-2, "Effects of Moisture on the Life of Power Plant Cables," 8/1994
One-Time Inspection Program (AMP B2.1.13)	Aboveground Carbon Steel Tanks, XI.M29 One-Time Inspection, XI.M32 Selective Leaching of Materials, XI.M33	PNP Technical Report, LR-AMPBD-21-ONETIME, "One-Time Inspection Program," Revision 1, 3/2/2005 NRC Safety Evaluation Report, "Palisades Plant - Risk-Informed Inservice Inspection Program (TAC No. MB4420)," 5/19/2003 NUREG-1785, "Safety Evaluation Report - Related to the License Renewal of the H.B. Robinson Steam Electric Plant, Unit 2," 3/2004 NUREG-1786, "Safety Evaluation Report - Related to the License Renewal of the R.E. Ginna Nuclear Power Plant," 5/2004 Safety Evaluation Report Related to the License Renewal of the Dresden Nuclear Power Station, Units 2 and 3 and Quad Cities Nuclear Power Station, Units 1 and 2, 7/2004

Applicant's Aging Management Program	GALL Aging Management Program	PNP LRA-AMP Basis Document and Other Documents Reviewed
Open Cycle Cooling Water Program (AMP B2.1.14)	Open-Cycle Cooling Water System, XI.M20	PNP Technical Report, LR-AMPBD-19-OCCW, "Open Cycle Cooling Water Program," Revision 1, 2/9/2005 Fleet Procedure FP-PE-SW-01, "Service Water and Fire Protection Inspection Program," Revision 1, 3/22/2004 EM-09-15, "Raw Water Corrosion Program," Revision 5, 8/19/2004 PNP Procedure COP-14, "Circulating Water System Chemistry," Revision 15, 5/20/2003 PNP Procedure COP-15, "Service Water System Chemistry," Revision 10, 10/12/2004 Engineering Manual Procedure EM-09-16, "Heat Exchanger Condition Assessment Program," Revision 4, 8/19/2004 "Master Heat Exchanger Testing Plan," Revision 2, 6/30/2003 Chemistry Procedure CH 1.11, "Biofouling and MIC Control Program," Revision 1, 4/22/2004 "Master Service Water and Fire Protection Inspection Plan," Revision 1, 1/4/2005
Overhead Load Handling Systems Inspection Program (B2.1.15)	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems, XI.M23	PNP Technical Report, LR-AMPBD-20-OVHDLOAD, "Overhead Load Handling Systems Inspection Program," Revision 1, 12/1/2004 Permanent Maintenance procedure MSM-M-13, "Overhead Crane Mechanical Inspection," Revision 26, 3/31/2005 Permanent Maintenance Procedure MSM-M-33, "Containment Boom Crane and Containment Hatch Crane Mechanical Inspection and Lubrication," Revision 5, 3/31/2005

Applicant's Aging Management Program	GALL Aging Management Program	PNP LRA-AMP Basis Document and Other Documents Reviewed
		Palisades Nuclear Plant, FHS-M-23, "Movement of Heavy Loads in the Spent Fuel Pool Area," Revision 24, 6/14/2005 Palisades Nuclear Plant, FHS-M-24, "Movement of Heavy Loads in the Containment Building Area," Revision 18, 3/8/2004 Palisades Nuclear Plant, Condition Report C-PAL-00-1657, "Containment Crane Rail Attachment Bolt Grout Pads Cracked," date closed 7/24/2000 Palisades Nuclear Plant, Condition Report C-PAL-96-1557, "Polar Crane Bridge Rail Splice Weld Cracks," date closed 1/15/1997 Palisades Nuclear Plant, Condition Report C-PAL-99-2091, "Exceeded Procedural Weight Limit on Polar Crane," date closed 12/15/1999 Palisades Nuclear Plant, Condition Report CAP036398, "Applicability of Crane Engineered Lifts for Reactor Head Removal/Reinstallation," date closed 9/17/2003 Palisades Nuclear Plant, Engineering Assistance Request 98-0680, "Upgrade L-1 Polar Crane by 2.5 Tons," final sign off 6/1/1999 Palisades Nuclear Plant, Engineering Assistance Request 99-0397, "Load Limits for the Polar Crane," final sign off 8/14/2000
Reactor Vessel Internals Inspection Program (AMP B2.1.17)	PWR Vessel Internals, XI.M16	PNP Technical Report, LR-AMPBD-23-VSLINTERNALS, "Reactor Vessel Internals Inspection Program," Revision 2, 3/1/2005 PNP Technical Report, LR-AMR-RVI, "License Renewal Aging Management Review - Reactor Vessel Internals"

Applicant's Aging Management Program	**GALL Aging Management Program**	**PNP LRA-AMP Basis Document and Other Documents Reviewed**
		PNP Technical Report, LR-AMPBD-02-ASMEISI, "ASME Section XI IWB, IWC, IWD, IWF Inservice Inspection Program Basis Document (Draft)", Revision 2, 2/28/2005 NRC Information Notice 84-18, "Stress Corrosion Cracking in PWR Systems," 3/7/1984 NRC Information Notice 98-11, "Cracking of Reactor Vessel Internal Baffle Former Bolts in Foreign Plants," 3/25/1998 CEOG Report, NPSD-1098 for CEOG Task 1011, "Evaluation of the Applicability of Baffle Bolt Cracking to Ft. Calhoun and Palisades Internals Bolts" (final report, Revision 0, 4/1998) NUREG-1782, "Safety Evaluation Report Related to the License Renewal of Ft. Calhoun Station, Unit 1," 7/2003
Steam Generator Tube Integrity Program (AMP B2.1.18)	Steam Generator Tube Integrity, XI.M19	PNP Technical Report, LR-AMPBD-24-SGINTEGRITY, "Steam Generator Tube Integrity Program," Revision 1, 12/1/2004 PNP Technical Report, LR-AMPBD-26-CHEMISTRY, "Water Chemistry Program," Program Basis Document NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," (July 2001) 10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants" NRC Generic Letter 97-06, "Degradation of Steam Generator Internals," 12/30/1997 NEI 97-06, "Steam Generator Program Guidelines," 1/2001

Applicant's Aging Management Program	GALL Aging Management Program	PNP LRA-AMP Basis Document and Other Documents Reviewed
		Engineering Manual Procedure EM-09-05 "Steam Generator Program," Revision 11, 12/1/2003 Engineering Manual Procedure EM-09-17 "Steam Generator Eddy Current Data Analysis Techniques," Revision 5, 2/5/2004 NRC Regulatory Guide 1.121 "Bases for Plugging Degraded PWR Steam Generator Tubes," 8/1976 NRC NUREG-1432 "Standard Technical Specifications for Combustion Engineering Pressurized Water Reactors," 4/1995 EPRI TR-102134, "PWR Secondary Water Chemistry Guidelines," Revision 5, Electric Power Research Institute, Palo Alto, CA, 5/2000 EPRI TR-105714, "PWR Primary Water Chemistry Guidelines," Revision 4, Electric Power Research Institute, Palo Alto, CA, 5/1999 Palisades Nuclear Plant, Condition Report CAP047487, "NRCIn2005-09: Indications in Alloy 600 TT SG Tube & Tube to Tubesheet Welds" TAC No. MC2747, "Palisades Plant-Review of Palisades Steam Generator Tube Inspection Reports for the Spring 2003 Outage" Palisades Technical Specification Sections 3.4 and 5.5, Technical Specification 5.6.8, "Steam Generator Tube Integrity Assessment from the 2003 Refueling Outage"

Applicant's Aging Management Program	**GALL Aging Management Program**	**PNP LRA-AMP Basis Document and Other Documents Reviewed**
Structural Monitoring Program (AMP B2.1.19)	Masonry Wall Program, XI.S5 Structures Monitoring Program, XI.S6 RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants, XI.S7	PNP Technical Report, LR-AMPBD-25-STRUCMON, "Structural Monitoring Program," Revision 2, 2/28/2005 Palisades Nuclear Plant, Engineering Manual Procedure EM-25-01, "Maintenance Rule Structural Monitoring," Revision 1, 6/28/2004 Palisades Nuclear Plant, Corrective Action Process CAP045406, "Water Leaking into Auxiliary Feed Pump Room," closed date 2/24/2005 Palisades Nuclear Plant, Condition Report C-PAL-96-0643, "Deterioration of Floor Plug above T-69 (South Patio)," closed date 7/2/1996 Palisades Nuclear Plant, Condition Report C-PAL-95-0168, "590' el. Aux Building Cement Cracking," closed date 5/5/1995 Palisades Nuclear Plant, Condition Report C-PAL-96-1241, "Spalled Concrete and Exposed Anchor Bolts at Turbine East Mezzanine," closed date 10/22/1997 Palisades Nuclear Plant, Condition Report C-PAL001179, "Standing Water and Debris Around Main Condenser Rock Anchors," closed date 5/3/2000 Palisades Nuclear Plant, Condition Report C-PAL-95-0018, "Watertight Barriers Not Passing Tests," closed 3/27/1995
Water Chemistry Program (AMP B2.1.21)	Water Chemistry, XI.M2	PNP Technical Report, LR-AMPBD-26-CHEMISTRY, "Water Chemistry Program," Revision 2, 2/28/2005 NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," 7/2001 Palisades Final Safety Analysis Report (FSAR), Revision 23

Applicant's Aging Management Program	GALL Aging Management Program	PNP LRA-AMP Basis Document and Other Documents Reviewed
		10 CFR 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants" EPRI TR-105714, "PWR Primary Water Chemistry Guidelines," Revision 5, 9/2003 EPRI TR-102134, "PWR Secondary Water Chemistry Guidelines," Revision 5, 5/2000 Chemistry Operating Procedure COP-1, "Primary Coolant System Chemistry," Revision 52, 4/24/2003 Chemistry Operating Procedure COP-2, "Chemical and Volume Control System Chemistry," Revision 25, 5/28/2003 Chemistry Operating Procedure COP-3, "Engineered Safeguards System Chemistry," Revision 22, 8/16/2002 Chemistry Operating Procedure COP-11, "Secondary System Chemistry," Revision 39, 3/12/2003 Chemistry Operating Procedure COP-27, "Spent Fuel Pool System Chemistry," Revision 18, 3/20/2003 Chemistry Operating Procedure COP-33, "Plant Water Storage and Transfer Systems Chemistry," Revision 13, 2/26/2004 NRC Generic Letter 97-01, "Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations," 4/1/1997 NRC Information Notice 82-37, "Cracking in the Upper Shell to Transition Cone Girth Weld of a Steam Generator at an Operating Pressurized Water Reactor," 9/16/1982

Applicant's Aging Management Program	GALL Aging Management Program	PNP LRA-AMP Basis Document and Other Documents Reviewed
		NRC Information Notice 84-18, "Stress Corrosion Cracking in Pressurized Water Reactor Systems," 3/7/1984 NRC Information Notice 85-65, "Crack Growth in Steam Generator Girth Welds," 7/31/1985 NRC Information Notice 89-33, "Potential Failure of Westinghouse Steam Generator Tube Mechanical Plugs," 3/23/1989 NRC Information Notice 90-04, "Cracking of the Upper Shell-To-Transition Cone Girth Welds in Steam Generators," 1/26/1990 NRC Information Notice 90-10, "Primary Water Stress Corrosion Cracking (PWSCC) of Inconel 600," 2/23/1990 NRC Information Notice 91-05, "Intergranular Stress Corrosion Cracking in Pressurized Water Reactor Safety Injection Accumulator Nozzles," 1/30/1991 NRC Information Notice 94-63, "Boric Acid Corrosion of Charging Pump Casing Caused by Cladding Cracks," 8/30/1994 NRC Information Notice 94-87, "Unanticipated Crack in a Particular Heat of Alloy 600 Used for Westinghouse Mechanical Plugs for Steam Generator Tubes," 12/22/1994 NRC Information Notice 96-11, "Ingress of Demineralizer Resins Increases Potential for Stress Corrosion Cracking of Control Rod Drive Mechanism Penetrations," 2/14/1996 NRC Information Notice 97-19, "Safety Injection System Weld Flaw at Sequoyah Nuclear Power Plant, Unit 2," 4/18/1997 NRC Information Notice 97-88, "Experiences During Recent Steam Generator Inspections,"

Applicant's Aging Management Program	GALL Aging Management Program	PNP LRA-AMP Basis Document and Other Documents Reviewed
		12/16/1997
Electrical Equipment Qualification Program (AMP B3.1)	Environmental Qualification (EQ) of Electrical Components, X.E1	PNP Technical Report, LR-AMPBD-11-EEQ, "Electrical Equipment Qualification Program," Revision 1, 12/1/2004 NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," 7/2001
Fatigue Monitoring Program (AMP B3.2)	Metal Fatigue of Reactor Coolant Pressure Boundary, X.M1	PNP Technical Report, LR-AMPBD-12-FATIGUE, "Fatigue Monitoring Program," Revision 1, 12/1/2004 PNP Technical Report, LR-TR-014-TLAA, "Time Limited Aging Analyses Report for Palisades Nuclear Plant License Renewal Project," Revision 1 (draft), 10/26/2004) NRC Generic Safety Issue (GSI) 190, "Fatigue Evaluation of Components for 60 Year Plant Life," 12/1999 NUREG/CR-6260, Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components, U.S. Nuclear Regulatory Commission, 3/1995 Nuclear Regulatory Commission Confirmatory Action Letter, 5/21/1986 NRC Bulletin 88 08, Thermal Stresses in Piping Connected to Reactor Coolant Systems, 6/22/1988 NRC Bulletin 88-11, Pressurizer Surge Line Stratification, 12/20/1988 EPRI 1007761 Materials Reliability Program: Operating Experience Regarding Thermal Fatigue of Piping Connected to PWR Reactor Coolant Systems (MRP-85), Final Report, 4/2003

Applicant’s Aging Management Program	GALL Aging Management Program	PNP LRA-AMP Basis Document and Other Documents Reviewed
		Corrective Action Document CAP045122, “Discrepancies in Plant Operating Transient Cycle Counts” Corrective Action Document CA026063, “Automatic Plant Operating Transient Cycle Counting”

Applicant’s AMR Sections and Systems for PNP	PNP LRA-AMR Basis Document and Other Documents Reviewed
3.1 Reactor Coolant System	PNP Technical Report, LR-AMR-PCS, “Primary Coolant System,” Revision 3, 6/21/2005 PNP Technical Report, LR-AMR-RVG, “Reactor Vessel,” Revision 2, 3/22/2005 PNP Technical Report, LR-AMR-RVI, Reactor Vessel Internals, Revision 3, 4/15/2005 PNP Technical Report, LR-AMR-RSG, “Replacement Steam Generators,” Revision 1, 6/10/2005
3.2 Engineered Safety Features	PNP Technical Report, LR-AMR-ESF, “Engineered Safeguards Features,” Revision 3, 7/8/2005
3.3 Auxiliary Systems	PNP Technical Report, LR-AMR-AGS, “Air and Gas Systems,” Revision 2, 6/30/2005 PNP Technical Report, LR-AMR-CCC, “Closed Cycle Cooling Systems,” Revision 3, 6/25/2005 PNP Technical Report, LR-AMR-CVC, “Chemical and Volume Control System,” Revision 3, 5/26/2005 PNP Technical Report, LR-AMR-DSS, “Diesel Support Systems,” Revision 3, 5/27/2005 PNP Technical Report, LR-AMR-FPS, “Fire Protection System,” Revision 2, 7/8/2005

Applicant's AMR Sections and Systems for PNP	PNP LRA-AMR Basis Document and Other Documents Reviewed
	PNP Technical Report, LR-AMR-HVC, "Heating, Ventilation and Air Conditioning Systems," Revision 2, 7/01/2005 PNP Technical Report, LR-AMR-MIS, "Miscellaneous Systems," Revision 2, 6/3/2005 PNP Technical Report, LR-AMR-OCC, "Open Cycle Cooling Water Systems," Revision 2, 6/10/2005 PNP Technical Report, LR-TR-008-MEAR, "Material Aging Effects Report, Palisades Nuclear Power Plant," Revision 2, 3/7/2005
3.4 Steam and Power Conversion Systems	PNP Technical Report, LR-AMR-SPC, "Steam and Power Conversion," Revision 2, 7/11/2005
3.5 Containments, Structures, and Component Supports	PNP Technical Report, LR-AMR-CMPSPT, "Component Supports," Revision 2, 7/15/2005 PNP Technical Report, LR-AMR-CNMT, "Primary Containment Structure," Revision 2, 7/15/2005 PNP Technical Report, LR-AMR-CONC, "Structural Concrete Commodities," Revision 2, 7/15/2004 PNP Technical Report, LR-AMR-MISC, "Miscellaneous and Bulk Commodities," Revision 2, 7/15/2005 PNP Technical Report, LR-AMR-STEEL, "Structural Steel Commodities," Revision 2, 7/15/2005 PNP Technical Report, LR-TR-008-MEAR, "Material Aging Effects Report, Palisades Nuclear Power Plant," Revision 2, 3/7/2005
3.6 Electrical, Instrumentation and Controls	PNP Technical Report, LR-AMPBD-17-NONEQELECOM, "Non-EQ Electrical Commodities Condition Monitoring Program" PNP Technical Report, LR-AMR-ELT, "Electrical Commodities," Revision 3, 4/18/2005

Attachment 6
List of Commitments

[Only those commitments which are applicable to this audit and review report are listed below.]

Commitment No.	Audit and Review Report Section	Description
5*	2.19.2	NMC will monitor the cumulative number of pressurizer temperature element nozzle fatigue cycles within the Fatigue Monitoring Program, and maintain a special action level to ensure that appropriate actions are taken if at any time the cycle count for any design basis event since 1993 reaches the number assumed by these analyses.
6* modified in 8/25/05 letter revised again in 9/2/05 letter	2.1.2	NMC will update the Alloy 600 Program to reflect the latest regulatory requirements and plant commitments at the time of submittal. The revised Alloy 600 Program description will be submitted for NRC review and approval by March 24, 2008.
7*	2.2.2	The supporting calculations for the Palisades RI-ISI program will be reviewed, and updated as needed, to reflect a 60-year operating period; and the program inspection scope will be updated accordingly, before the period of extended operation.
9*	2.10.2	The Quality Program implementation procedures will be expanded to apply the elements of corrective action, confirmation process, and administrative controls to both safety related and non-safety related systems, structures, and components that are subject to aging management review for license renewal.
15*	2.3.4	A Buried Services Corrosion Monitoring Program will be developed and implemented. Features of the program will include development and implementation of procedures for inspection of selected buried SSCs for corrosion, pitting and MIC. The periodicity of these inspections will be based on opportunities for inspection such as scheduled excavation and maintenance work.

Commitment No.	Audit and Review Report Section	Description
16*	2.7.4	Develop and implement procedures for periodic draining and cleaning of diesel fuel oil storage tanks, emergency diesel generator day tanks, and diesel fire pump day tanks. These procedures shall include steps to perform a visual inspection of interior tank surfaces for signs of degradation or corrosion, with acceptance criteria, corrective actions, and documentation of inspection results.
17*	2.7.4	Develop and implement procedures for periodic draining of water accumulated in the bottom of the fuel oil storage tanks and fuel oil day tanks for the diesel generators and diesel fire pumps.
18*	2.7.4	Develop and implement procedures for periodic ultrasonic measurement of thickness of the bottom of fuel oil storage tanks, emergency diesel generator day tanks, and diesel fire pump day tanks.
19*	2.8.4	The Structures Monitoring Program shall be revised to include specific inspection criteria and documentation requirements for verifying that walls, ceilings and floors that serve as Fire Protection Program fire barriers are verified to be free from aging related degradation that would impact the fire barrier's intended function.
20*	2.8.4	Plant procedures shall be revised to more specifically address aging related degradation and expectations for documentation of fire door condition.
21*	2.8.4	Develop and implement procedures to perform visual inspections for fire door clearances.
22*	2.8.4	Revise diesel-driven fire pump performance test procedures to more specifically address requirement to inspect and monitor fuel oil supply line for aging related degradation, and to document inspection results.

Commitment No.	Audit and Review Report Section	Description
23*	2.8.4	Develop and implement procedures for inspection of below grade fire protection system piping. Inspections shall occur when below grade piping is excavated for maintenance, and shall include pipe wall thickness (NDE or direct measurement) and documentation of aging related degradation of pipes. Procedures shall include acceptance criteria, and criteria for further corrective actions if acceptance criteria are not met.
24*	2.8.4	Plant procedures shall be revised to more specifically address identification of aging related degradation and expectations for documentation of fire hydrant condition. Also, these revisions shall include provisions to perform flow testing for fire hydrants within the scope of license renewal that are credited for fire suppression in the Palisades current licensing basis.
25*	2.8.4	Develop and implement procedures to replace all sprinkler heads prior to the end of the 50 year service life, or for testing of a representative sample of sprinkler heads prior to the end of the 50 year service life and at 10 year intervals thereafter, per requirements of NFPA 25, Section 5.3.
26*	2.10.4	A Non-EQ Electrical Commodities Condition Monitoring Program will be developed and implemented. Features of the program will include development and implementation of procedures to conduct periodic inspection of insulated cables and connectors, test sensitive instrumentation circuits, test medium voltage cables, and inspect manhole water levels.
27*	2.11.4	A One-Time Inspection Program will be developed and implemented. Features of the program are as described in the enhancement section of LRA Section B2.1.13.

Commitment No.	Audit and Review Report Section	Description
28*	2.13.4	Revise crane and fuel handling machine inspection procedures to specifically inspect for general corrosion on passive components making up the bridge, trolley, girders, etc., and to inspect rails of bridge cranes for wear. Revision should also include documentation of results of these inspections, acceptance criteria, and qualification requirements for inspectors and crane supervisors.
33* modified in 8/25/05 letter	2.14.4	NMC will participate in industry initiatives that will generate additional data on aging mechanisms relevant to reactor vessel internals (RVI), including void swelling, and develop appropriate inspection techniques to permit detection and characterization of features of interest. Recommendations for augmented inspections and techniques resulting from this effort will be incorporated into the Reactor Vessel Internals Program as applicable. The revised Reactor Vessel Internals Program will be submitted for NRC review and approval by March 24, 2009.
34* withdrawn in 8/25/05 letter	N/A	Preliminary Commitment 34 from NMC LRA transmittal letter dated March 22, 2005, is hereby withdrawn.
35*	2.16.4	Incorporate into the Structural Monitoring Program all structural members listed in Tables 3.5.2-1 through 3.5.2-10 that will use the Structural Monitoring Program as an AMR.
37*	2.19.4	A Fatigue Monitoring Program will be developed and implemented. Features of the program will include monitoring and tracking selected cyclic loading transients (cycle counting) and their effects on critical reactor pressure boundary components and other selected components.
38**	2.11.6	The final text and schedule of licensee commitments that are confirmed by NRC in the final SER for the Palisades renewed operating license will be incorporated into appropriate locations of the FSAR in the first regular FSAR update under 10 CFR 50.71(e) following NRC issuance of the renewed operating license.

Commitment No.	Audit and Review Report Section	Description
39** withdrawn and replaced in 9/16/2005 letter	2.3.2, 2.3.6	Visual inspections of a sample of buried carbon, low-alloy, and stainless steel components will be performed within ten years prior to entering, and within ten years after entering, the period of extended operation. Prior to the tenth year of each period, NMC will perform an evaluation of available data to determine if sufficient opportunistic inspections have been performed within that period to assess the condition of the components. If insufficient data exists, focused inspection(s) will be performed as needed.
40**	2.17.2	NMC will submit, for NRC review and approval, a comparison of EPRI TR-105714, Revision 5 with Revision 3 to identify the material changes that impact aging management and justify their acceptability by October 31, 2005. If necessary, the submittal will include a Water Chemistry Program description, revised to identify and justify use of TR-105714, Revision 5, as an exception to the GALL Report program description.
41**	2.17.2	NMC will submit, for NRC review and approval, a comparison of TR-102134, Revision 6 with Revision 3 to identify the material changes that impact aging management and justify their acceptability by October 31, 2005. If necessary, the submittal will include a Water Chemistry Program description, revised to identify and justify use of TR-102134, Revision 6, as an exception to the GALL Report program description.
42**	2.4.2	NMC will submit, for NRC review and approval, a comparison of TR-107396, Revision 1 with Revision 0 to identify the material changes that impact aging management and justify their acceptability by October 31, 2005. If necessary, the submittal will include a Closed Cycle Cooling Water Program description, revised to identify and justify use of TR-107396, Revision 1, as an exception to the GALL Report program description.

Commitment No.	Audit and Review Report Section	Description
43**	2.2.2	NMC will revise the ASME Section XI IWB, IWC, IWD, IWF aging management program descriptions in LRA Appendices A and B to reflect the 2001 Edition including the 2002 and 2003 Addenda of ASME Section XI. The revised program descriptions will identify exceptions to this code taken by the program, if any, that impact aging management effectiveness. Appropriate justification will also be provided to show that the exceptions, if any, still provide an acceptable level of aging management. The revised program descriptions will be submitted for NRC review and approval by October 31, 2005.
44**	2.5.2	NMC will revise the Containment Inservice Inspection Program description in the LRA to identify use of the 1998 Edition as an exception to the GALL Report. Exceptions taken to the 1998 Edition, if any, will be identified and justified as part of the program description. A comparison of the 1998 Edition with the 1995 Edition/1996 Addendum referenced in the GALL Report, Revision 0, or the 2001 Edition, including the 2002 and 2003 Addenda, referenced in the GALL Report, draft Revision 1 (publicly released on August 12, 2005), will also be developed to support the adequacy of the 1998 Edition of IWE and IWL for aging management. The revised program description and comparison will be submitted for NRC review and approval by October 31, 2005.
45**	2.9.2	NMC will revise the governing procedure for the Flow Accelerated Corrosion Program to include the value of 87.5% of nominal wall thickness for non-safety related piping as a trigger point to initiate engineering analysis to confirm that remaining wall thickness is acceptable to support the intended function or to determine corrective action, as applicable. This requirement will be implemented by March 24, 2009.

Commitment No.	Audit and Review Report Section	Description
46**	3.3.3.5	NMC will develop a new Compressed Air Program for Palisades. This program will manage aging in carbon steel components within the compressed, saturated or moist air environments of the compressed air systems. Compressed air system descriptions for LRA Appendices A and B will be submitted for NRC review and approval by October 31, 2005. In addition, LRA Appendix A and B descriptions of the One-Time Inspection Program, revised to delete reference to management of compressed air components, will be provided.

* The numbers for commitments up to 37 were assigned by the applicant in the March 22, 2005 letter.

** The numbers for commitments greater than 37 were assigned by the project team.