# Audit and Review Report for

# Plant Aging Management Reviews

# and Programs

Monticello Nuclear Generating Plant
Docket No.: 50-263

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Prepared by
Advanced Technologies and Laboratories International, Inc.
20010 Century Boulevard, Suite 500
Germantown, Maryland 20874
Contract No. DR-03-05-027

Prepared for
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
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## 1.0 Introduction and General Information

### 1.1 Introduction

By letter dated March 16, 2005, (ADAMS Accession Number ML050880241), the Nuclear Management Company, LLC (NMC, the applicant) submitted to the U.S. Nuclear Regulatory Commission (NRC) its application for renewal of Operating License DPR-22 for Monticello Nuclear Generating Plant (MNGP). The applicant requested renewal of the operating license for an additional 20 years beyond the 40-year current license term.

In support of the NRC staff's safety review of the license renewal application (LRA) for MNGP, 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 MNGP. The project team included both NRC staff and contractor personnel provided by Advanced Technologies and Laboratories, Inc. (ATL), RLEB-B's technical contractor. Attachment 2 lists the project team members as well as other NRC staff and ATL 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 Plan for License Renewal Application Aging Management Programs Aging Management Review Results, Monticello Nuclear Generating Station, Docket No. 50-263, ML051600008 (MNGP 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 MNGP 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 ATL's offices in Germantown, Maryland; and at the applicant's offices at the MNGP site in Monticello, Minnesota. The project team conducted onsite visits during the weeks of June 13, 2005, and July 25, 2005. The project team conducted a public exit meeting at the applicant's offices in Monticello, Minnesota, on August 18, 2005. Attachment 2 lists the applicant personnel and other individuals contacted by the project team in support of the work documented in this audit and review report. It also lists those attending the public exit meeting.

## 1.2 Background

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

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

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

If an applicant takes credit for a GALL Report program, it is incumbent on the applicant to ensure that its plant program addresses all 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 MNGP License Renewal Application

The MNGP 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 3, April 2001. Section 3 of the MNGP LRA provides the results of the AMPs for SCs that the applicant identified as subject to an AMR.

#### 1.3.1 MNGP License Renewal Application Tables

MNGP LRA Tables 3.0-1 and 3.0-2 provide descriptions of material, operational environment, and component types for the mechanical, structural, and electrical service SCs 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 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 Systems |
| 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 MNGP LRA section number; X again indicates the table number from Volume 1 of the GALL Report; the 2 indicates that this is the second table type (Table 2) in Section 3.X; and Y indicates the system table number. For example, within the reactor vessel, internals, and reactor coolant system subsection, the AMR results for the Reactor Coolant System - Reactor Head Vent System - Summary of Aging Management Evaluation are presented in Table 3.1.2-1, and the results for the Reactor Coolant System - Reactor Pressure Vessel - Summary of Aging Management Evaluation are in Table 3.1.2-2. In the engineered safety features subsection, the Engineered Safety Features - Automatic Pressure Relief System - Summary of Aging Management Evaluation results are presented in Table 3.2.2-1, and the Engineered Safety Features - Combustible Gas Control System - Summary of Aging Management Evaluation results are in Table 3.2.2-2.

The applicant compared the MNGP 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 MNGP LRA Table 1

MNGP LRA Table 1 provides a summary comparison of how the MNGP AMR results align with the corresponding tables of the GALL Report. The MNGP LRA Table 1 consists of the following columns: "Item Number," "Component," "Aging Effect/Mechanism", "AMPs", "Further Evaluation Recommended" and "Discussion" . These MNGP 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 five examples of information that might be contained within the "Discussion" column:

(1) Any "Further Evaluation Recommended" information 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, when it may not be intuitively obvious.

(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 MNGP LRA Table 2

The MNGP LRA Table 3.X.2-Y (Table 2) provides the detailed results of the AMRs for those components identified in MNGP LRA Section 2 as being subject to an AMR. There is a Table 2 for each of the components or systems within a system grouping (e,g., reactor coolant systems, engineered safety features, auxiliary systems, etc.). For example, the engineered safety features group contains tables specific to automatic pressure relief, combustible gas control, core spray, high-pressure coolant injection, primary containment mechanical, reactor core isolation cooling, residual heat removal, and secondary containment systems. All LRA Table 2's consist of the following nine columns:

(1) *Component Commodity.* Column 1 identifies the component or commodity types that are subject to an AMR. The component or commodity types are listed in alphabetical order.

(2) *Intended Function.* Column 2 identifies the license renewal intended functions for the listed component and commodities. Definitions and abbreviations of intended functions are listed in Table 2.1-1 in Section 2 of the MNGP LRA.

(3) *Material*. Column 3 lists the materials of the component or commodity type being evaluated.

(4) *Environment*. Column 4 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 MNGP LRA Table 3.0-1 and Table 3.0-2 for the mechanical, civil, and electrical components.

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

(6) *Aging Management Program*. Column 6 lists the program(s) used to manage the aging effect.

(7) *NUREG-1801 Volume 2 Item*. The applicant compared each combination of component type, material, environment, aging effect requiring management, and aging management program factors listed in LRA Table 2 to the Gall Report to identify consistencies. In Column 7, the applicant documents identified consistencies by noting the appropriate GALL Report item number. 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 applicant compared each combination of component type, material, environment, aging effect requiring management, and aging management program that has an identified GALL Report number and a Table 1 line reference number. Column 8 lists the corresponding line item from Table 1. If there is no corresponding item in the GALL Report, Column 8 is left blank.

(9) *Notes*. Column 9 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 a 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). The staff concurred with the NEI 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 MNGP.

MNGP LRA Table 2 contains the AMR results and indicates whether the results correspond to line items in the GALL Report. Correlations between a combination in the MRGP LRA Table 2 and a combination in Volume 2 of the GALL Report are identified in column 7 of Table 2. 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, column 8 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 recommend a plant-specific program. In these cases, the applicant considers the MNGP AMR evaluation to be consistent with the GALL Report, if an appropriate plant-specific AMP has been credited to manage aging.

### 1.4 Audit and Review Scope

The AMRs and associated AMPs that the project team reviewed are identified in the MNGP audit and review plan. The project team examined 43 of the MNGP AMPs and associated AMRs line items. The project team reviewed AMPs and AMRs that the applicant claimed were consistent with the GALL Report. The project team also reviewed certain plant-specific AMPs.

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 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.

The project team reviewed all MNGP LRA Table 2s AMRs 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 the MNGP LRA Table 3.X.2-Y (from Column 9 of the Table 2s discussed in Section 1.3 of this report), or reviewed and accepted by the project team on the basis of an NRC-approved precedent (see Section 1.5.3 below).

## 1.5 Audit and Review Process

The project team performed the audit and review 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 MNGP audit and review plan. This review process is summarized in this section.

### 1.5.1 MNGP Aging Management Programs

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

For eight (8) of the MNGP AMPs (B2.1.2; B2.1.3; B2.1.7; B2.1.8; B2.1.10, B2.1.11; B2.1.28; and B2.1.33) the project team also evaluated specific exceptions to the GALL’s description of program element 7, “Corrective Actions.” In a letter dated August 11, 2005 (ML052280269) responding to a project team question about the effects of approved relief requests and code cases on MNGP’s AMPs, the applicant identified specific exceptions to program element 7 that were not described in the MNGP LRA discussion for these AMPs. The project team evaluated these specific exceptions to program element 7 and documented its conclusions in the AMP evaluation sections of this audit and review report.

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

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

### 1.5.2 MNGP AMRs 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.

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

### 1.5.3 NRC-Approved Precedents

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

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

### 1.5.4 Updated Final Safety Analysis Review Supplement

Consistent with the SRP-LR, for the AMRs results and associated AMPs that it reviewed, the project team also reviewed the Updated Final Safety Analysis Review (USAR) 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 MNGP 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 MNGP 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 onsite visits, the project team also conducted detailed discussions and interviews with the applicant's license renewal project personnel and others personnel with technical expertise relevant to aging management.

## 1.6 Exit Meeting

The project team held a public exit meeting with the applicant on August 18, 2005, to discuss the results of its audits and reviews of the AMPs and AMRs results assigned to the project team. These discussions reflected the project team's work and its results, as documented in this audit and review report.

## 2.0 Aging Management Programs Audit and Review Results

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

## 2.1 10 CFR 50, APPENDIX J (MNGP AMP B2.1.1)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.1, "10 CFR 50, Appendix J," is an existing plant program that is consistent with GALL AMP XI.S4, “10 CFR Part 50, Appendix J,” with exceptions.

### 2.1.1 Program Description

The applicant states, in the MNGP LRA, that this program specifies pneumatic pressure tests and visual examinations to verify the structural and leak-tight integrity of the primary containment. An overall (Type A) pressure test assesses the capacity of the containment to retain design basis accident pressure. This test also measures total leakage through the containment pressure-retaining boundary. Local (Type B & C) tests measure leakage through individual penetration isolation barriers. These barriers are maintained to keep overall and local leakage under Technical Specification and plant administrative limits.

The applicant further states that these tests are performed at intervals determined by the risk and performance factors applicable to each tested item in accordance with governing regulations and standards. This risk and performance-based approach to testing provides reasonable assurance that developing leakage is detected and corrected well before it reaches a magnitude that could compromise containment function.

### 2.1.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.1 is consistent with GALL AMP XI.S4, with exceptions.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.1, including PBD/AMP-025, Rev 2, “Aging Management Program Basis Document - 10 CFR 50, Appendix J Program,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.S4.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.1 and associated bases documents against GALL AMP XI.S4 for consistency.

GALL AMP XI.S4 states that the containment leak rate tests (LRT) program is a monitoring program with no preventive actions specified. The applicant states, in MNGP LRA, that it uses Option B, which allows a variable risk-informed testing schedule for Types A, B, and C testing. Under Option B and a special NRC-approved one-time Type A test extension, the current maximum test intervals are 15 years for the Type A test, 10 years for most Type B tests, and 5 years for most Type C tests. The maximum interval applicable to the personnel air lock, as well as to the main steam, feed water, and purge isolation valves, is 30 months.

During the audit and review, the project team reviewed samples of the applicant’s procedures that are being used for the implementation of Appendix J leak rate program. These procedures include: EWI-08.06.01, “Primary Containment Leakage Rate Testing Program;” Procedure 0136, “Integrated Primary Containment Leak Rate Test;” Procedure 0137, “Master Local Leak Rate Test;” Procedure 0138, “Drywell Personnel Airlock Pressure and Leak Test;” Procedure 0135, “Pressure-Suppression Chamber Painted Surface Internal Inspection;” Procedure 0140, “Drywell Interior Surface Inspection;” Procedure 0446-B, “Type B and C Combined Leakage Check;” Procedure 0515, “Primary Containment Visual Examination for Structural Problems;” Procedure 4320-PM, “Drywell Penetration Airlock;” and Procedure 8080, “Primary Containment Hatch Closure.” The project team determined, based on this sampling review and the plant operating experience (see Section 2.1.5 of this audit and review report), that these procedures direct the processes necessary to test MNGP containment and all penetrations in accordance with 10 CFR 50 Appendix J.

The project team reviewed those portions of the applicant’s 10 CFR 50, Appendix J program for which the applicant claims consistent with GALL AMP XI.S4 and finds that they are consistent with the GALL Report AMP. Each program element in MNGP AMP B2.1.1 and associated program attribute assessment documents was evaluated and compared to the corresponding element in GALL AMP XI.S4. The project team finds that, but for the exception noted by the applicant, they are consistent with the GALL Report. Furthermore, the project team concludes that the applicant’s 10 CFR 50, Appendix J program provides reasonable assurance that the program will adequately manage plant aging. The project team finds the applicant’s 10 CFR 50, Appendix J program acceptable because it conforms to the recommended GALL AMP XI.S4, "10 CFR Part 50, Appendix J," with the exceptions as described below.

2.1.3 Exceptions to the GALL Report

The applicant states, in the MNGP LRA, that the exceptions to the GALL Report elements are as follows:

Exception 1:

| | |
|---|---|
| Element: | 1: Scope of Program |
| Exception: | Main steam isolation valves (MSIVs) are tested at 25 psig instead of at an accident pressure of 42 psig. |

The GALL Report identifies the following recommendations for “scope of program” program element associated with the exception taken:

> The scope of the containment LRT program includes all pressure-retaining components. Two types of tests are implemented. Type A tests are performed to measure the overall primary containment integrated leakage rate which is obtained by summing leakage through all potential leakage paths including containment welds, valves, fittings, and components that penetrate containment. Type B tests are performed to measure local leakage rates across each pressure-containing or leakage-limiting boundary for containment penetrations. Type A and B tests described in 10 CFR Part 50, Appendix J, are acceptable methods for performing these LRTs. Leakage testing for containment isolation valves (normally performed under Type C tests), if not included under this program, is included under LRT programs for systems containing the isolation valves.

In the MNGP LRA, the applicant indicates that Section III.C.2 of 10 CFR 50, Appendix J, requires, in part, that Type C testing be performed at the peak calculated accident pressure (Pa), which for MNGP is 42 psig. The outboard MSIVs are tested by pressurizing the volume between the inboard and outboard valves. The inboard MSIVs at MNGP are angled (Y-pattern globe) in the main steam lines to afford better closure characteristics. A test pressure of Pa (42 psig) acting under the inboard valve disc could lift the disc off its seat and cause excessive leakage into the vessel. Type C testing of these valves at a reduced pressure of 25 psig has been approved by the NRC (letter from Darrell G. Eisenhut, NRC, to D.M. Musolf, Nuclear Management Company (NMC), dated June 3, 1984). The project team determined that the inboard valves are the same design as the valves evaluated by the NRC, and an alternative to the test pressure used in the leakage test would have no impact on aging management. Therefore, the project team concludes that this exception is acceptable.

<u>Exception 2</u>:

| | |
|---|---|
| Element: | 5: Monitoring and Trending |
| Exception: | Type A test interval is extended, on a one-time basis, to 15 years, which exceeds the 10-year limit on interval given in NEI 94-01, “Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J.” |

The GALL Report identifies the following recommendations for “monitoring and trending” program element associated with the exception taken:

> Because the LRT program is repeated throughout the operating license period, the entire pressure boundary is monitored over time. The frequency of these tests depends on which option (A or B) is selected. With Option A, testing is performed on a regular fixed time interval as defined in 10 CFR Part 50, Appendix J. In the case of Option B, the interval for testing may be increased on the basis of acceptable performance in meeting leakage limits in prior tests. Additional details for implementing Option B are provided in NRC Regulatory Guide 1.163 and NEI 94-01, Rev. 0.

In the MNGP LRA, the applicant states that currently MNGP is under 10 CFR 50 Appendix J, Option B, “Performance-Based Requirement,” to perform the Type A containment integrated leakage rate test. Based on the provisions specified in the Appendix J, Option B and previous acceptable MNGP Type A test performance history, the test frequency for Type A testing would be 10 years. The most recent Type A test was performed in March 1993. Thus, the subsequent test would have to be performed no later than March 2003. Following general industry practice, MNGP submitted a request for one-time test interval extension to 15 years based on a plant-specific, risk-based evaluation. The NRC approved this request in a letter from L.M. Padovan, NRC, to D.L. Wilson, NMC, dated March 31, 2003. Therefore, MNGP will have to perform one Type A test no later than March 2008 prior to the period of extended operation. Any future Type A test frequency will be determined on the basis of the next Type A test results and the limit set forth in Appendix J, Option B.

The project team finds that, in addition to the integrated leakage test, Type A test requirements include visual examination of the containment exterior and interior to detect conditions that might adversely affect structural integrity or leak tightness. An examination is performed prior to each Type A test and between tests at nominal intervals of 40 months. Because MNGP is following its current licensing basis to have a one-time Type A test extended to 15 years, which ends prior to the period of extended operation, and the additional visual examination requirements are in place, the project team finds this exception to be acceptable.

2.1.4 Enhancements

None

2.1.5 Operating Experience

The applicant states, in the MNGP LRA, that the results of tests and examinations conducted since plant startup have demonstrated that the 10 CFR 50, Appendix J program is effective in maintaining the structural and leak tight integrity of the containment pressure boundary.

The project team reviewed sample specific self-assessment reports including Nuclear Oversight Observation Report 2002-003-5-007, core spray penetration X-16B expansion bellow leak modification package MP-97Q050, and electrical penetration JX-105A conductor seal leak work requests 87-04365 and 87-04427. The project team noted that the applicant’s Appendix J testing program has identified developing leakage through components and taken corrective actions.

The project team finds that, based on review of operating history, corrective actions, and self-assessments, MNGP’s 10 CFR Part 50, Appendix J program is continually monitored and enhanced to incorporate the results of operating experience; as such, it provides an effective means of managing aging associated with the structural integrity and leak tightness of the MNGP containment.

On the basis of its review of the above operating experience and discussions with the applicant's technical staff, the project team concludes that the applicant’s 10 CFR 50, Appendix J program will adequately manage the aging effects that are identified in the MNGP LRA for which this AMP is credited.

2.1.6 USAR Supplement

The applicant provides its USAR Supplement for the 10 CFR 50, Appendix J program in the MNGP LRA, Appendix A, Section 2.1.1 which states that the MNGP program specifies pneumatic pressure tests and visual examinations to verify the structural and leak tight integrity of the primary containment. An overall (Type A) pressure test assesses the capacity of the containment to retain design basis accident pressure. This test also measures total leakage through the containment pressure-retaining boundary. Local Type B & C tests measure leakage through individual penetration isolation barriers. These barriers are maintained to keep overall and local leakage under Technical Specification and plant administrative limits.

The applicant also states that tests are performed at intervals determined by the risk and performance factors applicable to each tested item in accordance with governing regulations and standards. This risk- and performance-based approach to testing provides reasonable assurance that developing leakage is detected and corrected well before it reaches a magnitude that could compromise containment function.

The applicant further states that visual examinations are performed prior to each Type A test. These examinations are also performed at least once during each containment inservice inspection period in which no Type A test is conducted. The examinations are performed to detect corrosion and other types of deterioration on the accessible surfaces of the containment.

The project team reviewed the USAR Supplement for MNGP 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 UFSAR supplement table and as required by 10 CFR 54.21(d).

### 2.1.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those 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 exceptions and the associated justifications and determined that the AMP, with the exceptions is adequate to manage the aging effects for which it is credited. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3). The project team also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.2 ASME SECTION XI INSERVICE INSPECTION, SUBSECTIONS IWB, IWC, AND IWD (MNGP AMP B2.1.2)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.2, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," is an existing plant program that is consistent with GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," with exceptions.

### 2.2.1 Program Description

The applicant states, in the MNGP LRA, that this program is part of the MNGP ASME Section XI Inservice Inspection Program, in accordance with ASME Section XI 1995 Edition through the 1996 Addenda, and subject to the limitations and modifications of 10 CFR 50.55a. The applicant also states that the program provides for condition monitoring of Class 1, 2, and 3 pressure-retaining components and their integral attachments.

The applicant further states that Class 1 and 2 piping is being inspected in accordance with the Risk-Informed Inservice Inspection (RI-ISI) Program as described in the Electric Power Research Institute (EPRI) Topical Report TR-112657, Rev. B-A, "Revised Risk Informed Inservice Inspection Evaluation Procedure," and that the NRC has approved the use of RI-ISI in a safety evaluation documented in NRC letter dated July 24, 2002, "Monticello Nuclear Generating Plant - Risk Informed Inservice Inspection Program (TAC NO. MB3819)," (ML021490050).

The applicant also states that the program is updated periodically as required by 10 CFR 50.55a and that the Plant Chemistry Program augments this program where applicable.

2.2.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.2 is consistent with GALL AMP XI.M1, with exceptions.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.2, including PBD/AMP-033, “Aging Management Program Basis Document - ASME Section XI Inservice Inspection, Subsection IWB, IWC and IWD," Revision 1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M1. The project team also reviewed ASME Section XI, Subsections IWB, IWC, and IWD, 1995 Edition through 1996 Addenda; the applicant’s document EWI-09.04.00, “ASME Section XI Inservice Inspection Program,” Revision 0; the applicant’s letter dated December 18, 2001, “Alternative to the ASME Boiler and Pressure Vessel Code Section XI Requirements for Class 1 and 2 Piping Welds - Risk Informed Inservice Inspection Program,” (ML020240381); and the related NRC safety evaluation dated July 24, 2002, “Monticello Nuclear Generating Plant - Risk Informed Inservice Inspection Program (TAC No. MB3819),” (ML021490050).

During the audit and review, the project team noted that in the MNGP LRA, the applicant’s “Program Description” for the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program and the applicant’s description for program elements “Parameters Monitored and Inspected,” “Detection of Aging Effects,” and “Monitoring and Trending” all make reference to the applicant’s Risk-Informed Inservice Inspection (RI-ISI) program or methodology. The project team noted that the NRC staff does not recognize or credit risk-informed ISI (or any other currently approved ISI relief requests) to support an applicant’s claim of consistency with the GALL Report. The project team asked the applicant to clarify the effects of its RI-ISI and other currently approved ISI relief requests on the LRA program description and its position regarding consistency with the GALL Report.

As a result of its reevaluation of the effects of the RI-ISI and other currently approved ISI relief requests, the applicant identified six exceptions to the program elements described in the GALL Report for AMP XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD.” By letter dated August 31, 2005 (ML052500294), the applicant identified these as exceptions for its MNGP AMP B2.1.2. The Project team’s evaluation of these exceptions is provided in Section 2.2.3 of this audit and review report.

The project team reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.2 and associated bases documents against the GALL AMP XI.M1 for consistency. In addition to the seven program elements, the project team also reviewed and evaluated one exception to the “Corrective Action” program element that was identified by the applicant during reevaluation of ISI relief requests. The project team’s evaluation of that exception is provided in Section 2.2.3 of this audit and review report.

The project team reviewed those portions of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program for which the applicant claims consistent with GALL AMP XI.M1 and, except for the differences mentioned above and evaluated as exceptions to the

GALL Report in Section 2.2.3 below, the project team finds that they are consistent with the GALL AMP. The project team concludes that the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program provides reasonable assurance that the aging effects will be managed so that the system and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation**.** The project team finds the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program acceptable because it conforms to the recommended GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD," with the exceptions as described below.

2.2.3 Exceptions to the GALL Report

The applicant states, in the MNGP LRA, that the exceptions to the GALL Report elements are as follows:

Exceptions 1 & 2

Element: 1: Scope of Program

Exceptions: Per 10 CFR 50.55a(b)(2)(xi), the requirements of IWB-1220 in the 1989 edition of ASME Section XI, "Components Exempt from Examination," are used for Class 1 piping instead of the 1995 Edition of ASME Section XI with the 1996 Addenda; and

Per 10 CFR 50.55a(b)(2)(xxi)(B), reused control rod drive (CRD) bolting must meet examination requirements for Table IWB-2500-1, Category B-G-2, Item B7.80 of ASME Section XI 1995 Edition with 1995 Addenda.

The GALL Report identifies the following recommendation for "scope of program" program element associated with the exceptions taken:

> The ASME Section XI program provides the requirements for ISI, repair, and replacement. The components within the scope of the program are specified in Subsections IWB-1100, IWC-1100, and IWD-1100 for Class 1, 2, and 3 components, respectively, and include all pressure-retaining components and their integral attachments in light-water cooled power plants. The components described in Subsection IWB-1220, IWC-1220 and IWD-1220 are exempt from the examination requirements of Subsections IWB-2500, IWC-2500, and IWD-2500.

The project team noted that both of the items which the applicant identified as exceptions are, in fact, requirements codified in 10 CFR 50.55a and that the "Scope of Program" program element in the GALL Report does not mention a specific ASME Section XI edition or addenda. The project team asked the applicant why it considered these items to be exceptions to the GALL Report. The applicant stated that they were "conservatively" identifying these items as exceptions solely because they are requirements that are not contained in ASME Section XI, 1995 Edition through 1996 Addenda, which is identified in the GALL Report Program Description for this AMP. The applicant stated that these codified requirements result in inspections being performed that would not otherwise be required by the 1995 Edition through

1996 Addenda of ASME Section XI. On the basis that the items identified by the applicant are requirements codified in 10 CFR 50.55a and that they require more stringent examinations than would otherwise be required by the 1995 Edition through 1996 Addenda of ASME Section XI, the project team finds these exceptions to be acceptable.

During the audit and review, the project team asked the applicant whether its approved ISI relief requests or code cases affect any of the elements of aging management programs. The applicant stated that code cases and relief requests for the MNGP ASME Section XI Inservice Inspection, Subsections IWB, IWC, IWD, and IWF, are valid for approximately 21 months into the period of extended operation and that the current inspection interval ends on May 31, 2012. In addition, the applicant provided results of its reevaluation of code cases and relief requests as documented in a letter dated August 31, 2005 (ML052500294). As a result of that reevaluation, the applicant identified six additional exceptions (Exceptions 3 through 8) to the GALL Report program elements. The additional exceptions to the GALL Report are described and evaluated in the following paragraphs:

<u>Exception 3</u>

Element: 4: Detection of Aging Effects
Exception: MNGP's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program includes implementation of Code Case N-307-2, which revises the ultrasonic examination volume for Class 1 bolting.

Code Case N-307-2 is listed in Table 1 of Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 13, January 2004. The applicant categorizes implementation of this code case to be an exception to the GALL Report because ASME Section XI, Table IWB-2500-1, Examination Category B-G-1 is referenced in description of the "Detection of Aging Effects" program element in GALL Report AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD." The applicant states that the only Class 1 bolts at MNGP with center holes are the reactor head closure studs and the reactor recirculation pump bolts. The applicant also states that provisions of this code case were added to Table IWB-2500-1, Figure IWB-2500-12, and Appendix VIII Supplement 8, 1.1(c) in the 2000 Addenda of ASME Section XI. The applicant states that this code case changes the portion of the bolt being evaluated but would still identify the presence of the relevant aging effect. On the basis that this code case only changes the portion of the component being examined, and that all applicable components still continue to be examined in a way that would identify the presence of relevant aging effects, the project team concludes that this is an acceptable exception to the GALL Report.

<u>Exception 4</u>

Element: 5: Monitoring and Trending
Exception: MNGP's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program includes implementation of Code Case N-526, which provides alternative requirements to be used for successive inspections required by IWB-2420 and IWC-2420 when areas of the vessel are found, by volumetric examinations, to contain subsurface flaws.

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

> For Class 1, 2, or 3 components, the inspection schedule of IWB-2400, IWC-2400, or IWD-2400, respectively, and the extent and frequency of IWB-2500-1, IWC-2500-1, or IWD-2500-1, respectively, provides for timely detection of degradation.

Code Case N-526 is listed in Table 1 of Regulatory Guide 1.147, “Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1,” Revision 13, January 2004. The applicant categorizes implementation of this code case to be an exception to the GALL Report because the successive inspections required by IWB-2420 and IWC-2420 may be waived when a flaw is found to be acceptable for continued service in accordance with IWB-3600. In a letter dated August 31, 2005, the applicant states that vessel aging effects continue to be managed and that any flaws for which successive inspections are waived are required to be acceptable for continued service in accordance with IWB-3600. The applicant also states that ASME Section XI requires that the sequence of component examinations established during the first inspection interval is repeated during each successive inspection interval, to the extent practical. On the basis that any flaws are determined to be acceptable in accordance with IWB-3600, plus the requirement that component examinations be repeated during successive inspection intervals (so that any flaw area will be re-examined at least once in each inspection interval), the project team concludes that this is an acceptable exception to the GALL Report.

<u>Exception 5</u>

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| Element: | 4: Detection of Aging Effects |
| Exception: | MNGP’s ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program will deviate from the requirements of ASME Section XI, Table IWB–2500-1 and Figure IWB-2500s-7(b) with regard to the examination volume for Category B-D components. |

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

> **Class 1 Components, Table IWB-2500-1**
> *Examination Category B-D, full penetration welds of nozzles in reactor vessels, pressurizers, steam generators (primary side), and heat exchangers (primary side)*: This category specifies volumetric examination of all nozzle-to-vessel welds and the nozzle inside radius.

The applicant identified that, based on MNGP’s implementation of ASME Section XI Code Case N-613-1, examination of Category B-D components (Full Penetration Welded Nozzles in Vessels) will deviate from the requirements of the 1995 Edition through 1996 Addenda of ASME Section XI, Table IWB-2500-1, Item No B3.90, and from the requirements of ASME Section XI, Figure IWB-2500-7(b). Specifically, Figure IWB-2500-7(b) requires that a minimum volume of material equal to a distance of one-half the reactor vessel shell thickness (i.e., a distance of approximately 2-1/2 inches for MNGP) be included in the examination volume on each side of the weld; however, the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program at MNGP will, instead, include a reduced examination volume of one-half inch of base metal on each side of the widest portion of the weld. The applicant has provided the following discussion as technical justification for the reduction in examination volume:

> The examination volume required by ASME Section XI, Figure IWB-2500-7(b) extends far beyond the weld into the base metal on each side of the widest portion of the weld and is unnecessarily large. The alternative re-defined the examination volume boundary to 1/2-inch of base metal on each side of the widest portion of the weld, removing from examination the base metal that was extensively examined during prior inspections and that is not in the high residual stress region associated with the weld. Creation of flaws in the volume excluded from the reduced examination is unlikely because of the low stress in the base metal away from the weld. The stresses caused by welding are concentrated at or near the weld. Cracks, should they initiate, occur in the high-stressed areas of the weld. These high-stress areas are contained in the volume that is defined by Code Case N-613-1 and are thus subject to examination. During the previous examinations, no indications exceeding the allowable limits of the preservice or inservice criteria were found in the reactor vessel nozzle to shell examination volumes including the base metal areas that will be excluded from examination by reduction of the previously used examination volume.

The project team has reviewed the applicant's description and technical justification for this exception, as summarized in the preceding paragraph. The project team has also reviewed applicant's letter to the NRC dated February 27, 2004, "Request for Authorization to Utilize Code Case N-613-1" (ML040610545), which provides a similar technical discussion and includes tables of previous examination results. On the basis that the examination volume will still include the heat-affected regions of base metal around the welds where new cracks are most likely to occur and that previous examinations of the base metal beyond the heat-affected regions have not detected any unacceptable indications, the project team has concludes that this exception is acceptable.

Exception 6

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| Element: | 7: Corrective Actions |
| Exception: | An approved alternative allows the use of the 2001 Edition of ASME Section XI in lieu of the 1995 Edition with the 1996 Addenda for repair/ replacement activities. |

The GALL Report identifies the following recommendations for the "corrective action" program element associated with the exception taken:

> For Class 1, 2, and 3, respectively, repair is in conformance with IWB-4000, IWC-4000, and IWD-4000, and replacement according to IWB-7000, IWC-7000, and IWD-7000. Approved BWRVIP-44 and BWRVIP-45 documents, respectively, provide guidelines for weld repair of nickel alloy and for weldability of irradiated structural components.

The applicant states that the alternative to use the 2001 Edition of ASME Section XI for repair/replacement has already been generically reviewed and approved by the NRC staff for aging management of systems and components within the scope of license renewal. Therefore, this alternative will not affect the aging management of components crediting ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD. The applicant provides the following text and states that it was published in the *Federal Register*/Volume 67, No. 187/Thursday, September 26, 2002/Rules and Regulations:

> Accordingly, an applicant may use Subsections IWB, IWC, IWD, IWE, IWF, and IWL of the ASME BPV Code (1997 Addenda, 1998 Edition, 1999 Addenda, and 2000 Addenda) as acceptable alternatives to the requirements of the 1995 Edition up to and including the 1996 Addenda of the ASME Code, Section XI, referenced in the GALL AMPS without the need to submit these alternatives for NRC review in its plant-specific license renewal application.
>
> The new limitations and modifications in 10 CFR 50.55a(b) require that the revised provisions be supplemented with additional inspection requirements as a condition for their use. The conclusions of the GALL report remain valid for the 1997 Addenda, 1998 Edition, 1999 Addenda, and 2000 Addenda of Section XI of the BPV Code with the use of these new limitations and modifications as discussed in this final rulemaking.

On the basis that this alternative, related to repair and replacement, has already been generically reviewed and approved by the NRC staff for aging management of systems and components within the scope of license renewal, the project team concludes that this item is not an exception and that with regard to this item, the program element affected by it is consistent with the GALL Report.

<u>Exception 7</u>

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|---|---|
| Element: | 4: Detection of Aging Effects |
| Exception: | MNGP's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program will include a risk-informed ISI methodology that provides an alternative to the ASME Section XI inservice inspection requirements with regards to (1) the number of locations inspected, (2) the locations inspected, and (3) the method of inspection. This alternative is applicable for welds in ASME Section XI categories B-F (Class 1 pressure retaining dissimilar metal welds in vessel nozzles), B-J (Class 1 pressure retaining welds in piping), C-F-1 (Class 2 pressure retaining welds in austenitic stainless steel or high-alloy piping), and C-F-2 (Class 2 pressure retaining welds in carbon or low-alloy steel piping). |

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

> Components are examined and tested as specified in Tables IWB-2500-1, IWC-2500-1, and IWD-2500-1, respectively, for Class 1, 2, and 3 components. The tables specify the extent and schedule of the inspection and examination methods for the components of the pressure-retaining boundaries. Alternative

approved methods that meet the requirements of !WA-2240 are also specified in these tables.

The applicant submitted a description of its risk-informed inservice inspection (RI-ISI) program to the NRC in a letter dated December 18, 2001, “Alternative to the ASME Boiler and Pressure Vessel Code Section XI Requirements for Class 1 and 2 Piping Welds - Risk Informed Inservice Inspection Program,” (ML020240381). NRC authorization for MNGP’s application of its RI-ISI program during the current (fourth) 10-year ISI interval was documented in a letter dated July 24, 2002, “Monticello Nuclear Generating Plant - Risk-Informed Inservice Inspection Program (TAC No. MB3818),” (ML021490050).

In its letter dated August 31, 2005, (ML052500294), the applicant provides the following justification for continuation of its RI-ISI program into the period of extended operation:

> The RI-ISI program maintains the fundamental requirements of ASME Section XI, such as the examination technique, examination frequency, and acceptance criteria. Although the RI-ISI program reduces the number of required examination locations, it maintains an acceptable level of quality and safety pursuant to 10 CFR 50.55a(a)3, by focusing inspections on the most safety significant welds with nondestructive examination techniques that are more focused towards finding the type of expected degradation as well as the types of flaws and degradation found during traditional inspections.
>
> A systematic approach was used to identify component susceptibility to common degradation mechanisms and to categorize these degradation mechanisms into the appropriate degradation categories with respect to their potential to result in a postulated leak or rupture in the pressure boundary. An evaluation to determine the susceptibility of components to a particular degradation mechanism that may be a precursor to a leak or rupture in the pressure boundary, and an independent assessment of the consequences of a failure at that location were performed. Industry and plant-specific piping operating experience was used to identify piping degradation mechanisms and failure modes, and consequence evaluations performed used probabilistic risk assessment to establish safety ranking of piping segments for selecting new inspection locations. The degradation mechanisms identified in the RI-ISI Program include thermal fatigue including thermal stratification, cycling, and striping (TASCS) and thermal transients (TT); intergranular stress corrosion cracking (IGSCC); and flow-accelerated corrosion (FAC). The consequences of pressure boundary failures were evaluated and ranked on their impact on core damage and early release. Therefore, redistributing the welds to be inspected with consideration of the safety significance of the segments provides assurance that segments whose failure have a significant impact on plant risk receive an acceptable and improved level of inspection.
>
> The RI-ISI examinations result in improved detection of service-related degradations over those currently required by ASME Section XI. Therefore, the aging effect of cracking continues to be adequately managed for the piping welds.

The project team has reviewed the applicant's technical justification for this exception. In addition, the project team reviewed the applicant's detailed RI-ISI program description provided in the letter of December 18, 2001, (ML020240381) and the NRC's authorization for MNGP to implement its RI-ISI program in the letter dated July 24, 2002, (ML021490050). Based on review of these documents, the project team determines the following:

(1) MNGP's letter of December 18, 2001, lists 15 systems that are encompassed by their RI-ISI program.

(2) For 10 of the 15 systems that are characterized by the RI-ISI methodology in the high-risk region or the medium-risk region, MNGP's RI-ISI program will change the location and category and, typically, will reduce the number of inspected welds from the ASME Section XI numbers, locations, and categories. However, a representative number of welds in each of these system will continue to be inspected per ASME Section XI requirements.

(3) For 5 of the 15 systems (component cooling water, control rod drive hydraulic, fuel pool emergency cooling, primary containment and atmospheric control, and torus hard vent systems) where all pipe welds are characterized by the RI-ISI methodology in the low-risk region, MNGP's RI-ISI program will eliminate inspection of welds previously inspected per ASME Section XI requirements.

(4) NRC staff review of the applicant's RI-ISI program, documented in the letter of July 24, 2002, concluded that MNGP's RI-ISI program will provide an acceptable level of quality and safety pursuant to 10 CFR 50.55a with regard to the number of inspections, locations of inspections, and methods of inspections.

Supported by previous NRC staff evaluation and approval of the applicant's RI-ISI program, the project team concludes that MNGP's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program as modified by the RI-ISI program approved by the NRC in the letter dated July 24, 2002, is acceptable for managing the aging effects of applicable components through the end of the applicant's current ISI inspection interval which ends on May 31, 2012, approximately 21 months into the extended operating period. This conclusion is based on (1) for the Class 1 and 2 welds affected by MNGP's implementation of RI-ISI, representative welds that are most susceptible to various age-related degradation mechanisms continue to be examined to ASME Section XI requirements; (2) any continuation of the RI-ISI program into the period of extended operation beyond May 31, 2012, will require NRC review and authorization per requirements of 10 CFR 50.55a; and (3) any subsequent NRC authorization to continue RI-ISI into the next ISI inspection interval will include consideration of any adverse industry or plant-specific operating experience that might preclude use of, or require modification of, the RI-ISI program to support aging management of affected components throughout the period of extended operation. On the basis of these considerations, the project team concludes that the applicant's implementation of RI-ISI is an acceptable exception to the "detection of aging effects" program element as described in the GALL Report for AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD."

<u>Exception 8</u>

Element: 4: Detection of Aging Effects

Exception: Based on a relief request approved per 10 CFR 50.55a, MNGP's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program does not include volumetric or surface examination of the reactor vessel stabilizer bracket welds to the exterior of the reactor pressure vessel. The reactor vessel stabilizer bracket welds are classified as Category B-H components (integral attachments for vessels) in ASME Section XI, 1995 Edition, in the examination category tabulation contained in IWB-2500; and, due to a change in ASME Section XI category nomenclature, they are classified as Category B-K components (welded attachments for vessels, piping, pumps, and valves) in ASME Section XI, 1995 Addenda, in the examination category tabulation contained in IWB-2500.

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

> *Examination category B-H for integral attachments for vessels*: This category specifies volumetric or surface examination of essentially 100% of the length of the attachment weld at each attachment subject to examination.
>
> [Note: The change in ASME Section XI examination category nomenclature was not picked up in the April 2001 version of the GALL Report. However, it is clear from the context that where the GALL Report says "examination category B-H" this is the same as examination category B-K in the 1995 Addenda of ASME Section XI. The remaining discussion in this audit and review report will use the nomenclature "examination category B-K."]

In its letter dated August 31, 2005, the applicant provides the following justification for not performing a volumetric or surface examination of the reactor vessel stabilizer bracket welds as specified by ASME Section XI and described in the GALL Report:

> Four RPV [reactor pressure vessel] stabilizer brackets are attached to the Class 1 RPV with full penetration fillet welds at 0/, 90/, 180/, and 270/ RPV azimuth at an elevation of 994'-2". The RPV stabilizers are connected with flexible couplings to the brackets on the RPV and also to the biological shield wall. The RPV stabilizers, brackets, and their attachment welds are designed to withstand and resist local loads (jet reaction forces) and seismic loads while allowing axial and radial movement due to normal thermal growth. The RPV stabilizer brackets do not provide structural support during normal operation. The MNGP RPV has never experienced jet reaction forces or seismic events, therefore the stabilizers, brackets, and attachment welds have not experienced the loads for which they are designed.
>
> The area around the stabilizers is extremely congested. The vessel stabilizer brackets are surrounded by mirror insulation that is secured by cable hangers and buckles, ventilation ductwork with support bracing, and electrical installations such as thermocouples. All of this equipment must be relocated and restored to provide access to the stabilizers for examination of the welds. Additionally, due

to the location of the stabilizer brackets and the lack of a working platform at the stabilizer location, a complex scaffold installation is required to provide access to the examination location.

As an alternative to the requirements of the ASME Section XI Code, Table IWB-2500-1, Category B-K, Item B10.10, MNGP proposes to perform a surface examination on the stabilizer brackets if local (jet reaction forces) or seismic design loads are experienced.

In addition, the applicant states that a one-time VT-3 visual inspection of the accessible areas of all four of the welded attachments was performed during the refueling outage that occurred in 2005 with no reportable conditions noted.

The applicant also states that a relief from this inspection will have no effect on aging management of the components in scope crediting these programs. The welds are part of the external surface of the reactor vessel. Aging management for the vessel external surface is discussed in MNGP LRA Table 3.1.2-2, “Reactor Coolant System - Reactor Pressure Vessel.”

The project team reviewed the applicant’s justification for this exception. In addition, the project team reviewed the NRC’s letter dated January 6, 2005, “Monticello Nuclear Generating Plant - Fourth 10-Year Inservice Inspection Interval Request for Relief No. 4 (TAC. No MC2222),” (ML042320425), in which the NRC staff approved the applicant’s request for relief from the requirements of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code with regard to the requirements of Table IWB-2500-1, Category B-K, Item B10.10 for inspection of the reactor vessel stabilizer bracket welds.

On the basis of the information reviewed, plus additional discussions with the applicant, an RAI (RAI B2.1.2-1) was issued to obtain additional technical basis to accept this exception. The RAI was transmitted to the applicant in NRC letter dated August 18, 2005 (ML052310044). The applicant was requested to describe details of the type of weld used for the stabilizer bracket attachment, to describe applicable examination requirements at the time of vessel manufacture and any available examination results, to describe inspections that have been performed since initial start-up of the plant, to identify and describe stressors that the welds experience during normal operation and state whether the welds have experienced any stressors different from the normal operating stressors, and to provide a summary of any related industry experience with similar welds known to the applicant.

In a response dated September 16, 2005 (ML052630320), the applicant provided the following additional information with regard to weld type and weld examinations:

> The four 3 1/2-inch thick stabilizer brackets are welded to the outside of the reactor pressure vessel (RPV) with a double-bevel groove weld (3/16-inch root opening, 1/8-inch root face, and 30-degree groove angle) and a concave reinforcing fillet. At the time of vessel manufacture, before welding the stabilizer brackets to the RPV, an ultrasonic (UT) examination was conducted of the vessel shell surface where the brackets were to be welded. The UT of the vessel shell was to a depth at least equal to the thickness of the bracket and over the entire area of the subsequent connection, plus a band all around this area of a width equal to half the thickness of the bracket. After the stabilizer brackets were welded to the vessel, a magnetic particle examination

was conducted of the welds. Since initial manufacture, the only examination of the stabilizer bracket welds was conducted in March 2005. This was a VT-3 visual examination of the stabilizer brackets using a flashlight and mirror. The examination looked for cracks or linear indications, wear, corrosion, and contaminants. No reportable indications were found on any of the four stabilizer brackets as a result of this examination.

The applicant's response also provided the following bases to conclude that degradation of the stabilizer bracket welds is unlikely:

> Degradation of the stabilizer bracket welds is unlikely because the cumulative fatigue usage factor for the stabilizer brackets is extremely low, so cracking due to fatigue is not expected to occur.
>
> The brackets and welds are made of carbon steel, and stress corrosion cracking is not applicable for this material; furthermore, during reactor operation, the drywell is maintained in an inert atmosphere with the reactor pressure vessel at high temperatures, so loss of material due to general corrosion is not expected to occur.
>
> MNGP does not use boric acid or a borated solution as a moderator in the reactor coolant system. Therefore, loss of material due to boric acid corrosion of external surfaces does not occur.
>
> The RPV stabilizers are connected with flexible couplings to the brackets on the RPV and to the biological shield wall. The RPV stabilizers, brackets, and their attachment welds are designed to withstand and resist local loads (jet reactor forces) and seismic loads while allowing axial and radial movement due to normal thermal growth. During normal operation there is no loading on the stabilizer brackets; and the stabilizers, brackets and attachment welds have never experienced the loads for which they were designed.
>
> Because of design differences, the Duane Arnold plant was able to conduct surface examinations on portions of their stabilizer bracket attachment welds in April 2005 and no reportable indications were found. In addition, the MNGP staff does not know of any failures or defects of these or similar welds at any other BWRs.

Based on the applicant's additional information which states that an appropriate original inspection of the stabilizer brackets and welds was performed, that there are no stressors to cause degradation of the brackets or welds during normal operation, that there have been no operational events subjecting the brackets or welds to abnormal stressors, that a recent VT-3 examination of the brackets found no indications of weld or bracket degradation, and that industry operating experience does not suggest occurrence of any age-related degradation of the stabilizer brackets or welds, the project team concludes that the above-described exception to the "detection of aging effects" program element as described in the GALL Report for AMP XI.M1, ASME Section XI, Subsections IWB, IWC, and IWD, is acceptable.

### 2.2.4 Enhancements

None

2.2.5 Operating Experience

The applicant states, in the MNGP LRA, that a review of operating experience for MNGP ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program identified no adverse trends or issues with program performance and that problems were identified and corrected prior to causing any significant impact to safe operation or loss of intended functions. The applicant further states that adequate corrective actions were taken to prevent recurrence. The applicant states that the MNGP ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD program effectively monitors the condition of the pressure retaining components within the License Renewal (LR) boundary and ensures aging effects are acceptably managed. The applicant states that appropriate guidance is contained in MNGP procedures for indications of degradation requiring re-evaluation, repair, or replacement.

In review of the applicant's program basis document for the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program, the project team noted that several items were listed in the document as "variances" from the requirements of the GALL Report, but that these variances were not identified as exceptions to GALL in the MNGP LRA. The project team asked the applicant to explain the meaning of the "variances" identified in the program basis document. In response to the project team's question, the applicant states that in the program basis document the documentation of "variances" was intended to summarize features of its program as currently implemented. The applicant also provided the following statement:

> Some of the items identified as "variances" are features to the MNGP ASME Section XI ISI Program that exceed the requirements of NUREG 1801, Section XI Inservice Inspection Program; and because they exceed the requirements of NUREG-1801, they are not exceptions to GALL. The remainder of the items are related to current term relief requests, but they have no bearing on license renewal commitments because the basis for the relief requests and the period of time during which the relief request is applicable generally will not carry through the period of extended operation.

The project team reviewed the applicant's response together with additional information contained in the applicant's program basis document. On the basis of this review, the project team concluded that the items that the applicant had identified as "variances" from the GALL Report are not exceptions to GALL because they do not delete or reduce the requirements of any of the GALL Report program elements. On this basis, the project team finds the applicant's response to be acceptable.

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

2.2.6 USAR Supplement

The applicant provides its USAR Supplement for the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program in the MNGP LRA, Appendix A, Section 2.1.2, which states that the MNGP program is part of the MNGP ASME Section XI Inservice Inspection program and that this program is in accordance with ASME Section XI 1995 Edition through 1996 Addenda and is subject to the limitations and modifications of 10 CFR 50.55a. The USAR Supplement states that the program provides for condition monitoring of Class 1, 2, and 3 pressure-retaining components and their integral attachments.

The USAR Supplement further states that Class 1 and 2 piping is being inspected in accordance with the Risk-Informed Inservice Inspection (RI-ISI) Program as described in the Electrical Power Research Institute (EPRI) Topical Report TR-112657, Rev. B-A, Revised Risk Informed Inservice Inspection Evaluation Procedure and that the NRC has approved the use of RI-ISI in a safety evaluation documented in NRC letter dated July 24, 2002, “:Monticello Nuclear Generating Plant - Risk Informed Inservice Inspection Program (TAC NO. MB3819).”

The USAR Supplement goes on to say that the program is updated periodically as required by 10 CFR 50.55a and that the Plant Chemistry Program augments this program where applicable.

The project team finds that the applicant’s description of its RI-ISI program in this USAR Supplement is acceptable and is consistent with the project team’s evaluation of MNGP’s current-term implementation of RI-ISI as documented in Section 2.2.3 of this audit and review report.

The project team reviewed the USAR Supplement for MNGP 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 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 exceptions and the associated justifications and determines that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3). The project team also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.3 ASME SECTION XI, SUBSECTION IWF (MNGP AMP B2.1.3)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.3, "ASME Section XI, Subsection IWF," is an existing plant program that is consistent with GALL AMP XI.S3, “ASME Section XI Inservice Inspection, Subsection IWF” with an enhancement.

### 2.3.1 Program Description

The applicant states, in the MNGP LRA, that this program is part of the MNGP ASME Section XI Inservice Inspection Program. The ASME Section XI, Subsection IWF program is performed in accordance with ASME Section XI 1995 Edition through the 1996 Addenda and 10 CFR 50.55a and provides for condition monitoring of Class 1, 2, 3, and MC component supports. Component supports are selected for inspection in accordance with the ASME code classification. The quantity of component supports selected for examination is increased as a result of discovered support deficiencies. Visual inspection is the primary method for identifying deficiencies.

### 2.3.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.3 is consistent with GALL AMP XI.S3, with an enhancement.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.3, including PDB/AMP-024, “Aging Management Program Basis Document - ASME Section XI, Subsection IWF,” Revision 1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.S3. The project team also reviewed ASME Section XI, Subsection IWF, 1995 Edition through 1996 Addenda; and the applicant’s documents EWI-09.04.00, “ASME Section XI Inservice Inspection Program,” Revision 0, and PEI-02.05.02, “Visual Examination of Components and Their Supports,” Revision 0.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.3 and associated bases documents against the GALL AMP XI.S3 for consistency. During the audit and review, the project team asked the applicant whether its approved ISI relief requests or code cases affect any of the elements of its aging management programs. In response to this question, the applicant identified one ISI relief request as an exception to the “Corrective Action” element of GALL AMP XI.S3. The project team’s evaluation of this exception is documented in Section 2.3.3 of this audit and review report.

The project team reviewed those portions of the applicant’s ASME Section XI Inservice Inspection, Subsection IWF program for which the applicant claims consistent with GALL AMP XI.S3 and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s ASME Section XI Inservice Inspection, Subsection IWF program provides reasonable assurance that the aging effects for Class 1, 2, 3 and MC component supports will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation. The project team finds the applicant’s ASME Section XI Inservice Inspection, Subsection IWF program acceptable because it conforms to the recommended GALL XI.S3, “ASME Section XI Inservice Inspection, Subsection IWF," with the enhancement and exception as described below.

### 2.3.3 Exceptions to the GALL Report

In the MNGP LRA, the applicant states that, after enhancement of its current program, there will be no exceptions to program elements of GALL AMP XI.S3, ASME Section XI, Subsection IWF. However, during the audit, the project team asked the applicant whether its approved ISI relief requests or code cases affect any of the elements of its aging management programs. In a letter dated August 31, 2005 (ML052500294), the applicant identifies, for Code Case N–491-2, the following exception to the GALL Report program element:

| | |
|---|---|
| Element: | 7: Corrective Actions |
| Exception: | Corrective measures may be performed on a component support to return the support to its design condition after acceptance by evaluation or test without requiring additional examinations. |

The GALL Report identifies the following recommendations for “corrective action” program element associated with the exception taken:

> In accordance with IWF-3122, supports containing unacceptable conditions are evaluated or tested, or corrected before returning to service. Corrective actions are delineated in IWF-3122.2. IWF-3122.3 provides an alternative for evaluation or testing to substantiate structural integrity and/or functionality.

The applicant states that most of the provisions of the original code case were added to the ASME Section XI 1990 Addenda but that the provisions of Code Case N-491-2 were added to IWF-3112.3 and IWF-3122.3 in the 1997 Addenda. Because some of the provisions of Code Case N-491-2 were added by an ASME Section XI addenda later than what is referenced in the GALL Report, the applicant has identified these provisions as an exception to the ASME Section XI, Subsection IWF program as described in the GALL Report.

The applicant states in its letter dated August 31, 2005 (ML052500294), that this exception to the corrective action program element of GALL Report AMP XI.S3 will have no impact on the aging management for the component supports. The project team reviewed the applicant’s description of this exception together with the applicable ASME Section XI requirements specified in ASME Section XI, 1995 Edition through 1996 Addenda. On the basis that the applicant’s aging management program provides the inspections required by ASME Section XI, Subsection IWF and requires reasonable and appropriate corrective actions before returning a defective component to service, the project team agrees that this exception will have no detrimental impact on the adequacy of aging management for the affected components. On this basis, together with its review of operating experience for the ASME Section XI, Subsection IWF program (see Section 2.3.5 below), the project team finds this exception to be acceptable.

### 2.3.4 Enhancements

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

| | |
|---|---|
| Element: | 1: Scope of Program |
| Enhancement: | The MNGP ASME Section XI, Subsection IWF Program will be enhanced to provide inspections of Class MC components supports consistent with NUREG-1801, Chapter III, Section B.1.3, “Supports for ASME Class MC Components.” |

The GALL Report identifies the following recommendation for “scope of program” program element associated with the enhancement:

> Starting with the 1990 addenda to the 1989 edition, the scope of Subsection IWF was revised. The required percentages of each type of nonexempt support subject to examination were incorporated into Table IWF-2500-1. The revised percentages are 25% of Class 1 nonexempt piping supports, 15% of Class 2 nonexempt piping supports, 10% of Class 3 nonexempt piping supports, and 100% of supports other than piping supports (Class 1, 2, 3, and MC). For pipe supports, the total sample consists of supports from each system (such as main steam, feedwater, residual heat removal), where the individual sample sizes are proportional to the total number of nonexempt supports of each type and function within each system. For multiple components other than piping within a system of similar design, function, and service, the supports of only one of the multiple components are required to be examined. To the extent practical, the same supports selected for examination during the first inspection interval are examined during each successive inspection interval.

During the audit and review, the project team asked the applicant to provide more details about its current IWF program and to identify the inspections that the enhancement will add to the current program. In response, the applicant provided the following information:

> The current MNGP IWF Program does not include VT-3 examination of MC supports.
>
> The current MNGP IWE Program includes general visual examinations of MC components and their supports in accordance with ASME Section XI, Table IWE-2500-1.

The applicant states that the following MC supports are included in examinations conducted under the current MNGP IWE Program:

Torus/ring header seismic restraints
Drywell male and female stabilizers
Shield stabilizers
Torus columns
Torus saddles
Torus header columns
Downcomer bracing

The applicant stated that for the period of extended operation, the MNGP License Renewal ASME Section XI, Subsection IWF program will perform VT-3 examination of MC supports listed above in accordance with ASME Section XI, Table IWF-2500-1 in compliance with the inservice inspection requirements of the 1995 Edition with the 1996 Addenda of Section XI. Also, for the period of extended operation, the MNGP License Renewal ASME Section XI, Subsection IWE program will continue to perform the general visual examination of MC components and their supports listed above in accordance with ASME Section XI, Table IWE-2500-1.

The project team reviewed the applicant's response together with the applicant's program basis document for the IWF Program. The project team concludes that by adding a requirement for VT-3 inspection of MC component supports into the current program, the applicant's current program will be consistent with the GALL AMP XI.S3. On this basis, the project team finds the applicant's response acceptable.

The project team noted that the MNGP LRA provides a general confirmation that MNGP's aging management program is in accordance with requirements of ASME Section XI, 1995 Edition through 1996 Addenda, and asked the applicant to provide detailed confirmation that the program is in compliance with specific requirements of ASME Section XI, Table IWF-2500-1. In response, the applicant provided the following statement:

> MNGP examines non-exempt Class 1 piping supports in accordance with Table IWF-2500-1, which specifies the extent of examination as 25% for each inspection interval. To the extent practical, the same supports selected for examination during the first inspection interval shall be examined during each successive inspection interval.
>
> MNGP examines non-exempt Class 2 and 3 piping supports and supports other than piping supports in accordance with Table IWF-2500-1, which specifies the extent of examination as 15%, 10%, and 100%, respectively, for each inspection interval. To the extent practical, the same supports selected for examination during the first inspection interval shall be examined during each successive interval.

The project team reviewed the applicant's response together with the requirements stated in ASME Section XI, Table IWF-2500-1. Based on these reviews, the project team concludes that the applicant's response is consistent with the requirements of ASME Section XI, Table IWF-2500-1. On this basis, the project team finds the applicant's response acceptable.

The project team asked the applicant to supply additional information confirming that the parameters monitored or inspected by MNGP's aging management program include those listed in GALL AMP XI.S3 for the program element "parameters monitored or inspected." In response, the applicant provided the following statement:

> MNGP's implementing procedure for visual examination of components and their supports includes parameters inspected consistent with those provided in NUREG-1801, XI.S3, ASME Section XI, Subsection IWF Program for IWF-2500.

The project team reviewed the applicant's implementing procedure against the parameters listed GALL AMP XI.S3. On the basis of this review, the project team concludes that appropriate parameters are included in the MNGP program and determines that the applicant's response is acceptable.

The project team asked whether the applicant's program, when enhanced as described in the MNGP LRA, will provide for inspection of all MNGP Class MC supports that are rolled up into applicable line items of the GALL Report, Chapter II, Section B1.3, Supports for ASME Class MC Components, where ASME Section XI, Subsection IWF is the specified aging management program. In response the applicant provided the following statement:

When the ASME Section XI, Subsection IWF Program is enhanced, all MNGP MC supports will be rolled up into the applicable NUREG-1801 line items to the extent required by ASME Section XI, Table IWF-2500-1.

The project team reviewed the applicant's response together with the applicant's proposed enhancement to the existing program as described in the MNGP LRA and evaluated in the applicant's Program Basis documents. Based on this review, the project team concludes that appropriate components are included in the applicant's program as required by ASME Section XI, Table IWF-2500-1. On this basis, the project team determined the applicant's response to be acceptable.

Based on the applicant's responses to the project team's questions and review of associated documents provided by the applicant, the project team concluded that the existing MNGP program, when enhanced as described in the LRA, will be fully consistent with the aging management program elements described in GALL AMP XI.S3, "ASME Section XI, Subsection IWF."

The applicant states, in the MNGP LRA, that the enhancement is required to satisfy the NUREG-1801 aging management program recommendations and that the enhancement is scheduled for implementation prior to the period of extended operation. On the basis of its evaluations of the applicant's program against the GALL Report's recommendations, together with its review of operating experience for the MNGP AMP B2.1.3 program (see Section 2.3.5, below), 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.

2.3.5 <u>Operating Experience</u>

The applicant states, in the MNGP LRA, that implementation of the MNGP ASME Section XI, Subsection IWF Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

The applicant further states that this program has demonstrated on several occasions that it provides reasonable assurance that aging effects are being managed for Class 1, 2, 3, and MC component supports susceptible to loss of material and loss of mechanical function. The applicant states that this has been verified by review of NRC inspection reports, INPO evaluations, audits, self-assessments, and its Corrective Action Program. In addition, the applicant states that MNGP has been performing a general visual examination of accessible Class MC component supports in accordance with the ASME Section XI, Subsection IWE Program and has not identified any aging effects of concern.

On the basis of its evaluation of the applicant's program against the GALL Report's recommendations, its review of the above industry, and its plant-specific operating experience and discussions with the applicant's technical staff, the project team concludes that the applicant's ASME Section XI, Subsection IWF program will adequately manage the aging effects that are identified in MNGP LRA for which this AMP is credited.

### 2.3.6 USAR Supplement

The applicant provides its USAR Supplement for the ASME Section XI Inservice Inspection, Subsection IWF program in a letter dated June 10, 2005, Enclosure 2, Appendix A, Section A2.1.3, which states that the MNGP program is part of the MNGP ASME Section XI Inservice Inspection program. The ASME Section XI Subsection IWF program is performed in accordance with ASME Section XI 1995 Edition through the 1996 Addenda and 10 CFR 50.55a and provides for condition monitoring of Class 1, 2, 3, and MC component supports. Component supports are selected for inspection in accordance with the ASME code classification. The quantity of component supports selected for examination is increased as a result of discovered support deficiencies. Visual inspection is the primary method for identifying deficiencies.

Section A2.1.3 also states that, prior to the period of extended operation, the MNGP ASME Section XI, Subsection IWF Program will be enhanced to provide inspections of Class MC components supports consistent with NUREG-1801, Chapter III Section B1.3.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.3, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program as identified in the SRP-LR USAR Supplement table and as required by 10 CFR 54.21(d).

### 2.3.7 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 aging management program being consistent with the GALL Report 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 USAR 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 BOLTING INTEGRITY (MNGP AMP B2.1.4)

This program is reviewed by NRR-DE staff and addressed in Section 3 of the SER related to the MNGP LRA.

## 2.5 BURIED PIPING & TANKS INSPECTION (MNGP AMP B2.1.5)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.5, "Buried Piping & Tanks Inspection," is an existing plant program that is consistent with GALL AMP XI.M34, “Buried Piping and Tanks Inspection,” with enhancements.

### 2.5.1 Program Description

The applicant states, in the MNGP LRA, that the Buried Piping and Tanks Inspection program consists of preventive and condition monitoring measures to manage the aging effects for buried piping, conduit and tanks in scope for license renewal. Buried components in scope for license renewal include carbon steel piping, bolting, conduit and tanks (loss of material due to general, crevice, galvanic, MIC and pitting corrosion) and cast iron piping (loss of material due to general, crevice, galvanic, MIC and pitting corrosion and selective leaching). Preventive measures consist of protective coatings and/or wraps on buried components. Condition monitoring consists of periodic inspections of buried components. In addition, buried components are not routinely uncovered during maintenance activities. Therefore, other system monitoring and functional testing activities are relied upon to provide effective degradation aging management of buried piping and tanks. Some of these activities are neither preventive nor mitigative in nature, but they do provide indication of a leak. However, the potential problem is detected at an early stage (i.e., small leak) such that repairs can be made prior to loss of component intended function.

The applicant also states the program will be implemented prior to the period of extended operation and will include procedural enhancements to: (1) the scope of program that will be updated to implement procedures to include inspections of buried components when they are uncovered; (2) the parameters monitored or inspected will include the Diesel Fuel Oil Storage Tank, T-44 for scheduled internal inspections; and (3) for detection of aging effects will be revised to include a provision that if evaluations of pipe wall thickness show a susceptibility to corrosion, further evaluation as to the extent of susceptibility will be performed. The Buried Piping and Tanks Inspection program will be revised to specify a 10-year buried pipe inspection frequency. The Buried Piping and Tanks Inspection program will be revised to specify a 10-year Diesel Fuel Oil Storage Tank, T-44, internal inspection frequency; and (4) the Buried Piping and Tanks Inspection program will be revised to include a review of previous buried piping issues to determine possible susceptible locations.

### 2.5.2 Consistency with the GALL Report

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

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.5, including PBD/AMP, "Aging Management Program Basis Document - Buried Pipe and Tank Inspection Program," Rev. 1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M34.

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

The project team reviewed those portions of the applicant’s Buried Piping & Tanks Inspection program for which the applicant claims consistent 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 Piping & Tanks Inspection program provides reasonable assurance that buried pipes, components and tanks will be managed for aging effects during the period of extended operation. The project team finds the applicant's Buried Piping & Tanks Inspection program acceptable because it conforms to the recommended GALL XI.M34, "Buried Piping and Tanks Inspection," with the enhancements as described below.

2.5.3 Exceptions to the GALL Report

None

2.5.4 Enhancements

The applicant states in the MNGP LRA that the enhancements in meeting the GALL Report elements are as follows:

Enhancement 1

| | |
|---|---|
| Element: | 1: Scope of Program |
| Enhancement: | The Buried Tank and Inspection program will be updated to implement procedures to include inspections of buried components when they are uncovered. |

The GALL Report identifies the following recommendation for "scope of program" program element associated with the enhancement taken:

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

The applicant states, in the MNGP LRA, that the scope of the Buried Tank and Inspection program will be updated to implement procedures to include inspections of buried components when they are uncovered. In interviewing the applicant's technical staff about the enhanced program, the applicant responded that enhanced program will capture inspection opportunities when buried components are uncovered at times other than during the scheduled buried piping inspection. In addition, the excavating procedure will be updated to perform inspection(s), when buried components are uncovered. The project team reviewed the applicant's response, evaluated plant procedures and finds that this enhancement to be an acceptable change that will provide the MNGP AMP B2.1.5 to be consistent with the aging management program elements described in GALL AMP XI.M34.

Enhancement 2

| | |
|---|---|
| Element: | 3: Parameters Monitored or Inspected |
| Enhancement: | The applicant will add the Diesel Fuel Oil Storage Tank T-44 internal inspections to list of scheduled inspections in the Buried Pipes and Tank Inspection Program. |

The GALL Report identifies the following recommendation for “parameters monitored or inspected” program element associated with the enhancement taken:

> The program monitors parameters such as coating and wrapping integrity that are directly related to corrosion damage of the external surface of buried carbon steel piping and tanks. Coatings and wrappings are inspected by visual techniques. Any evidence of damaged wrapping or coating defects, such as coating perforation, holidays, or other damage, is an indicator of possible corrosion damage to the external surface of piping and tanks.

During the audit and review, the project team asked the applicant what types of inspections will be performed for this program before the period of extended operation. In response, the applicant states a visual and UT inspection of the buried Diesel Fuel Oil Storage Tank, T-44, was performed in 2003, and the inspection showed no significant loss of material due to corrosion on the tank interior. The applicant noted in their response to the project team’s question about buried components that both visual and UT inspections of the Diesel Fuel Oil Storage Tank will be performed before entering the period of extended operation.

The project team reviewed the applicant’s response and evaluated plant procedures. To further clarify how the applicant intends to inspect the buried Diesel Fuel Oil Storage Tank externally, per the GALL Report recommendation, the project team sent the applicant a Request for Additional Information (RAI 2.1.5-1).

<u>Enhancement 3</u>

| | |
|---|---|
| Element: | 4: Detection of Aging Effects |
| Enhancement: | The Buried Piping and Tanks Inspection Program will be revised to include a provision that if evaluations of pipe wall thickness show a susceptibility to corrosion, further evaluation as to the extent of susceptibility will be performed. The Buried Piping and Tanks Inspection Program will be revised to specify a 10-year buried pipe inspection frequency. The Buried Piping and Tanks Inspection Program will be revised to specify a 10-year Diesel Fuel Oil Storage Tank, T-44, internal inspection frequency. |

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

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

In the MNGP LRA, the applicant states that there is a regular inspection of underground piping for the off-gas system going to the plant stack. This was a requirement made by the Offsite Safety Review Committee to preclude leakage of off-gas from the underground piping for any reason including aging effects. In addition, visual and/or UT inspections will be performed at 10-year intervals for buried piping. An internal visual and UT inspection of the Diesel Fuel Oil Storage Tank, T-44 will also be performed at 10-year intervals.

During the audit and review, the project team asked the applicant if the program will be performed before the period of extended operation. The applicant states in their response to the project team's question about buried components that both visual and UT inspections of the Diesel Fuel Oil Storage Tank and buried piping near the off-gas stack will be performed before entering the period of extended operation.

The project team reviewed the applicant's response, evaluated plant procedures, and finds that the enhancements described here are acceptable and will provide assurance that MNGP AMP B2.1.5 is consistent with the aging management program elements described in GALL AMP XI.M34.

<u>Enhancement 4</u>

| | |
|---|---|
| Element: | 5: Monitoring and Trending |
| Enhancement: | The underground piping inspections are to include a review of previous buried piping issues to determine possible susceptible locations. |

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

> Results of previous inspections are used to identify susceptible locations.

During the audit and review, the applicant provided technical information as to the statement that MNGP has mild soil conditions. In response to the project team's questions, the applicant provided technical data which did indicate this conclusion based on information for pH, chloride, and sulfate concentrations. The enhancement of the monitoring and trending program element will include a review of previous buried piping issues to determine possible susceptible locations. The project team reviewed the applicant's response, evaluated plant procedures, and finds the MNGP AMP B2.1.5 to be consistent with the aging management program elements described in GALL AMP XI.M34.

On the basis of review of the above enhancements and the review of operating experience for the MNGP AMP B2.1.5 program (see Section 2.5.5, below), the project team finds these enhancements to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

2.5.5 <u>Operating Experience</u>

The applicant states in the MNGP LRA that the MNGP Buried Piping and Tanks Inspection program relies on preventive measures, periodic inspections, and functional testing to manage the aging effects of buried components.

The applicant states that MNGP operating experience has shown no buried component failures for systems in scope for license renewal.  Operating experience has not identified any locations that are more susceptible to corrosion than any other locations.  This indicates that the protective coating and wraps have provided excellent protection for the buried components. The only failures of buried components were on the well water piping system and the instrument air system to the cooling towers.  These systems are not safety related and not in scope for LR.  The locations of the failures are not near any buried components in scope for LR.  The well water piping failure was postulated to be due to MIC and not a failure of the protective coating.  The cause of the failure of the instrument air line is yet to be determined. Periodic visual and UT inspections of buried pipe have shown no significant loss of material due to pipe corrosion.  Periodic UT inspections of the Diesel Fuel Oil Storage Tank interior in the past have shown no significant loss of material due to corrosion.  Periodic functional testing of the ESW and Fire Header systems has shown no functional failures.  Periodic vapor point monitoring and ground-water monitoring near the Diesel Fuel Oil Storage Tank have shown no functional failures of the Storage Tank or the Diesel Fuel Oil Lines.

The project team reviewed and evaluated the operating experience provided in MNGP 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, MNGP operating experience documentation, and discussions with the applicant's technical staff, the project team concludes that the applicant’s AMP B.2.1.5 will adequately manage the aging effects that are identified in MNGP LRA for which this AMP is credited.

### 2.5.6 USAR Supplement

The applicant provides its USAR Supplement for the Buried Piping and Tanks Inspection program in a letter dated June 10, 2005, Enclosure 2, Appendix A, Section A2.1.5, which states that the MNGP program consists of preventive and condition monitoring measures to manage the aging effects for buried piping, conduit, and tanks in scope for license renewal. Buried components in scope for license renewal include carbon steel piping, bolting, conduit and tanks (loss of material due to general, crevice, galvanic, MIC and pitting corrosion), and cast iron piping (loss of material due to general, crevice, galvanic, MIC, and pitting corrosion and selective leaching).  Preventive measures consist of protective coatings and/or wraps on buried components.  Condition monitoring consists of periodic inspections of buried components.

In addition, the applicant states that buried components are not routinely uncovered during maintenance activities.  Therefore, other system monitoring and functional testing activities are relied upon to provide effective degradation aging management of buried piping and tanks. Some of these activities are neither preventive nor mitigative in nature, but they do provide indication of a leak.  However, the potential problem is detected at an early stage (i.e., small leak) such that repairs can be made prior to loss of component intended function.

Section A2.1.5 also states that prior to the period of extended operation:

1) The Buried Piping and Tanks Inspection Program will update the implementing procedures to include inspections of buried components when they are uncovered.
2) The Diesel Fuel Oil Storage Tank, T-44, internal inspection will be added to the list of scheduled inspections in the Buried Piping and Tanks Inspection Program.
3) The Buried Piping and Tanks Inspection Program will be revised to include a provision that if evaluations of pipe wall thickness show a susceptibility to corrosion, further evaluation as to the extent of susceptibility will be performed.
4) The Buried Piping and Tanks Inspection Program will be revised to specify a 10-year buried pipe inspection frequency.
5) The Buried Piping and Tanks Inspection Program will be revised to specify a 10-year inspection frequency for Diesel Fuel Oil Storage Tank T-44.
6) The Buried Piping and Tanks Inspection Program will be revised to include a review of previous buried piping issues to determine possible susceptible locations.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.5, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program as identified in the SRP-LR USAR Supplement table and as required by 10 CFR 54.21(d).

### 2.5.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the project team has reviewed the enhancements and determined that the implementation of the enhancements prior to the period of extended operation would result in the existing aging management program being consistent with the GALL Report 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 USAR 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 BUS DUCT INSPECTION (MNGP AMP B2.1.6)

This program is reviewed by NRR-DE staff and addressed in Section 3 of the SER related to the MNGP LRA.

## 2.7 BWR CONTROL ROD DRIVE RETURN LINE NOZZLE (MNGP AMP B2.1.7)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.7, "BWR Control Rod Drive Return Line Nozzle," is an existing plant program that is consistent with GALL AMP XI.M6, “BWR Control Rod Drive Return Line Nozzle,” with an exception.

### 2.7.1 Program Description

The applicant states, in the MNGP LRA, that this program is part of MNGP ASME Section XI, Inservice Inspection Program. The BWR Control Rod Drive Return Line Nozzle program is in accordance with ASME Section XI 1995 Edition through the 1996 Addenda, and provides for condition monitoring of the BWR Control Rod Drive Return Line (CRDRL) nozzle.

### 2.7.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.7 is consistent with GALL AMP XI.M6, with an exception.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.7, including PBD/AMP-037, "Aging Management Program Basis Document - BWR Control Rod Drive Return Line Nozzle," Revision 1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M6.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.7 and associated bases documents against GALL AMP XI.M6 for consistency. During the audit and review, the project team asked the applicant whether its current approved ISI relief requests or code cases affect any of the program elements of its aging management programs. The applicant identified the alternative to use the 2001 Edition of ASME Section XI for repair/replacement as an exception to the "corrective action" program element of the GALL AMP XI.M6. The project team's evaluation of this exception and the exception described in the MNGP LRA is documented in Section 2.7.3 of this report.

The project team reviewed those portions of the applicant's BWR Control Rod Drive Return Line Nozzle program for which the applicant claims consistent with GALL AMP XI.M6 and finds that they are consistent with the GALL Report AMP. The project team finds that, but for the exception noted by the applicant, they are consistent with the GALL Report. Furthermore, the project team concludes that the applicant's BWR Control Rod Drive Return Line Nozzle Program will manage the effects of aging so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation. The project team finds the applicant's BWR Control Rod Drive Return Line Nozzle program acceptable because it conforms to the recommended GALL XI.M6, "BWR Control Rod Drive Return Line Nozzle," with the exception as described below.

### 2.7.3 Exceptions to the GALL Report

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

Element: 3. Parameters Monitored/Inspected
Element: 4. Detection of Aging Effects
Element: 5. Monitoring and Trending

Exception: The NUREG-0619 augmented inspections are not performed.

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

> The aging management program (AMP) monitors the effects of cracking on the intended function of the component by detecting and sizing cracks by ISI in accordance with Table IWB 2500-1 and NUREG-0619.
>
> The extent and schedule of inspection, as delineated in NUREG 0619, assures detection of cracks before the loss of intended function of the component. Inspection recommendations include liquid penetrant testing (PT) of the CRDRL nozzle blend radius and bore regions and the reactor vessel wall area beneath the nozzle, return-flow-capacity demonstration, CRD-system-performance testing and ultrasonic inspection of welded connections in the rerouted line. The inspection is to include base metal to a distance of one-pipe-wall thickness or 0.5 in., whichever is greater, on both sides of the weld.
>
> The inspection schedule of NUREG-0619 provides timely detection of cracks.

The applicant stated that it removed the CRDRL nozzle safe end and capped the CRDRL nozzle in 1977. The applicant also stated that it modified the CRDRL nozzle again in 1986. The purpose of this modification was to remove that portion of the existing weld butter layer susceptible to IGSCC by re-cladding the weld prep area with corrosion resistant cladding and by installing a new nozzle cap of 316 L nuclear grade stainless steel. Because of these modifications, the applicant states in its LRA that the required augmented inspections on the CRDRL nozzle, as specified in NUREG-0619 through NRC Generic Letter (GL) 80-95, are no longer necessary. Although the applicant did not perform those NUREG-0619 specified augmented inspections, it did follow the guidance in Section 8.2 of NUREG-0619 for other inspections and maintenance activities related to the CRD system. The following is a summary of MNGP activities related to Section 8.2 of NUREG-0619:

- Section 8.2(3) - The final PT inspection of the CRDRL nozzle showed no indications. A system flow and performance test was conducted with satisfactory results.

- Section 8.2(3a) - The welded connection joining the rerouted CRDRL to the Reactor Water Clean-up System is inspected every refueling outage. This inspection is performed with UT and includes base metal to a distance of one-pipe-wall thickness, or 0.5 inches, whichever is greater, on both sides of the weld.

- Section 8.2(3b) - The remainder of the CRDRL does not meet the definition of Class 1, 2, or 3 pipe and, therefore, NUREG-0313 does not require augmented inspections.

- Section 8.2(3c) - Since carbon steel piping was retained in the exhaust header, procedures were developed to perform the following activities: (1) inspection and replacement the hydraulic control unit (HCU) filters every refueling outage, and (2) flushing the exhaust water header every refueling outage.

The applicant stated that its commitment made in response to GL 80-95, to implement the requirements for the CRDRL nozzle specified in Section 8 of NUREG-0619 has been completed. The activities described above relating to NUREG-0619 Sections 8.2(3a) and 8.2(3c) are existing NRC commitments and will continue through the period of extended operation.

On the basis of its review of the completion of MNGP CRDRL nozzle related modifications, the completion of MNGP commitments made in response to GL 80-95, and operating experience for the MNGP AMP B2.1.7 program (see Section 2.7.5, below), the project team finds this exception to be acceptable.

During the audit and review, the project team asked the applicant whether its current approved ISI relief requests or code cases affect any of the program elements of its aging management programs. In a letter dated August 31, 2005 (ML052500294), the applicant identified the following additional exception to the GALL Report program element:

> Element: 7: Corrective Actions
> Exception: An approved alternative allows the use of the 2001 Edition of ASME Section XI in lieu of the 1995 Edition with the 1996 Addenda for repair/ replacement activities.

The GALL Report Identifies the following recommendations for the "corrective action" program element associated with the exception taken:

> Repair and replacement procedures are equivalent to those requirements in the ASME Section XI. Repair is in conformance with IWB-4000 and replacement occurs according to IWB-7000. As discussed in the appendix to this report, the staff finds that licensee implementation of the guidelines in BWRVIP-48, as modified, will provide an acceptable level of quality for inspection and flaw evaluation of the safety-related components addressed in accordance with 10 CFR Part 50, Appendix B, corrective actions.

The applicant states that the alternative [to use the 2001 Edition of ASME Section XI for repair/ replacement] has already been generically reviewed and approved by the NRC staff for aging management of systems and components within the scope of license renewal and that this alternative will not affect the aging management of components crediting ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD. The applicant provides the following text and states that it was published in the *Federal Register*/Volume 67, No. 187/Thursday, September 26, 2002/Rules and Regulations:

> Accordingly, an applicant may use Subsections IWB, IWC, IWD, IWE, IWF, and IWL of the ASME BPV Code (1997 Addenda, 1998 Edition, 1999 Addenda, and 2000 Addenda) as acceptable alternatives to the requirements of the 1995 Edition up to and including the 1996 Addenda of the ASME Code, Section XI, referenced in the GALL AMPS without the need to submit these alternatives for NRC review in its plant-specific license renewal application.
>
> The new limitations and modifications in 10 CFR 50.55a(b) require that the revised provisions be supplemented with additional inspection requirements as a condition for their use. The conclusions of the GALL Report remain valid for the 1997 Addenda, 1998 Edition, 1999 Addenda, and 2000 Addenda of Section XI of

the BPV Code with the use of these new limitations and modifications as discussed in this final rulemaking.

On the basis that this alternative, as it relates to repair and replacement, has already been generically reviewed and approved by the NRC staff for aging management of systems and components within the scope of license renewal, the project team concludes that this item does not need to be classified as an exception, and that with regard to this item, the program element affected by it is consistent with the GALL Report.

2.7.4 Enhancements

None

2.7.5 Operating Experience

The applicant states, in the MNGP LRA, that its BWR Control Rod Drive Return Line Nozzle program inspections are implemented through the ISI Program Plan, which incorporates applicable requirements of the ASME Code. The inspection and testing methodologies have been effective in detecting aging effects due to cracking. Engineering evaluations were performed based on plant and industry experience and component and programmatic corrective actions implemented as required.

As indicated in Section 2.7.3 of this audit and review report, the BWR CRDRL nozzle has been modified. In 1977, the CRDRL nozzle safe end was removed and the CRDRL nozzle was capped. In 1986, the CRDRL nozzle was modified again by removing the portion of the existing weld butter layer susceptible to IGSCC, by re-cladding the weld prep area with corrosion resistant cladding, and by installing a new nozzle cap.

The applicant states that, since the last modification to the capped nozzle in 1986, the following inspections have been conducted:

1. In April 1996, a liquid penetrant examination (PT) was performed on the nozzle to end cap weld. No reportable indications were found.

2. In March 2005, a visual examination (VT-1) was performed on the nozzle to end cap weld. No reportable indications were found.

During the audit and review, the project team noted that the CRDRL nozzle remains within the MNGP ISI Program plan. The CRDRL nozzle is included in the ISI Program, IWB-2500-1, Examination Category B-D. The ISI Program has two areas scheduled for inspection: the inner radius and the nozzle to vessel weld.

The project team reviewed the operating experience provided in MNGP 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 operating experience and discussions with the applicant's technical staff, the project team concludes that the applicant’s AMP B.2.1.7 will adequately manage the aging effects that are identified in MNGP LRA for which this AMP is credited.

2.7.6 USAR Supplement

The applicant provides its USAR Supplement for the BWR Control Rod Drive Return Line Nozzle program in the MNGP LRA, Appendix A, Section 2.1.7, which states that the MNGP program is part of the MNGP ASME Section XI Inservice Inspection Program. The BWR Control Rod Drive Return Line Nozzle program is in accordance with ASME Section XI 1995 Edition through the 1996 Addenda and provides for condition monitoring of the BWR CRDRL nozzle.

The applicant states that the program is updated periodically as required by 10 CFR 50.55a.

The project team reviewed the USAR Supplement for MNGP 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).

2.7.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team finds that those program elements for which the applicant claimed consistency with the GALL 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. he 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 USAR 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 BWR FEEDWATER NOZZLE (MNGP AMP B2.1.5)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.8, "BWR Feedwater Nozzle," is an existing plant program that is consistent with GALL AMP XI.M5, "BWR Feedwater Nozzle," with an enhancement.

2.8.1 Program Description

The applicant states, in the MNGP LRA, that this program is part of the MNGP ASME Section XI Inservice Inspection Program. The BWR Feedwater Nozzle program is in accordance with ASME Section XI 1995 Edition through the 1996 Addenda with Appendix VIII. The program provides for condition monitoring of the BWR feedwater nozzles. The BWR feedwater nozzles were all repaired in 1977 and the safe ends were all replaced in 1981 using a welded-in thermal sleeve with a tuning fork design.

### 2.8.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.8 is consistent with GALL AMP XI.M5, with an enhancement.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.8, including PBD/AMP-036, “Aging Management Program Basis Document - BWR Feedwater Nozzle,” Revision 1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M5.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in MNGP AMP B2.1.8 and associated bases documents against the GALL AMP XI.M5 for consistency. During the audit and review, the project team asked the applicant whether its current approved ISI relief requests or code cases affect any of the program elements of its aging management programs. The applicant identified the alternative to use the 2001 Edition of ASME Section XI for repair/replacement as an exception to the “corrective action” program element of the GALL AMP XI.M5. The project team’s evaluation of this exception is documented in Section 2.8.3 of this report.

The project team reviewed those portions of the applicant’s BWR Feedwater Nozzle program for which the applicant claims consistent with GALL AMP XI.M5 and finds that they are consistent with the GALL Report AMP. The project team finds that, but for the enhancement noted by the applicant, they are consistent with the GALL Report. Furthermore, the project team concludes that the applicant’s BWR Feedwater Nozzle program will manage aging effects so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation. The project team finds the applicant’s BWR Feedwater Nozzle program acceptable because it conforms to the recommended GALL XI.M5, “BWR Feedwater Nozzle," with the enhancement and exception as described below.

### 2.8.3 Exceptions to the GALL Report

During the audit and review, the project team asked the applicant whether its current approved ISI relief requests or code cases affect any of the program elements of its aging management programs. In a letter dated August 31, 2005 (ML052500294), the applicant identified the following exception to the GALL Report program element:

| | |
|---|---|
| Element: | 7: Corrective Actions |
| Exception: | An approved alternative allows the use of the 2001 Edition of ASME Section XI in lieu of the 1995 Edition with the 1996 Addenda for repair/ replacement activities. |

The GALL Report Identifies the following recommendations for the “corrective action” program element associated with the exception taken:

> Repair and replacement procedures are equivalent to those requirements in the ASME Section XI. Repair is in conformance with IWB-4000 and replacement occurs according to IWB-7000. As discussed in the appendix to this report, the

> staff finds that licensee implementation of the guidelines in BWRVIP-48, as modified, will provide an acceptable level of quality for inspection and flaw evaluation of the safety-related components addressed in accordance with 10 CFR Part 50, Appendix B, corrective actions.

The applicant states that the alternative [to use the 2001 Edition of ASME Section XI for repair/ replacement] has already been generically reviewed and approved by the NRC staff for aging management of systems and components within the scope of license renewal and therefore this alternative will not affect the aging management of components crediting ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD. The applicant provides the following text and states that it was published in the *Federal Register*/Volume 67, No. 187/Thursday, September 26, 2002/Rules and Regulations:

> Accordingly, an applicant may use Subsections IWB, IWC, IWD, IWE, IWF, and IWL of the ASME BPV Code (1997 Addenda, 1998 Edition, 1999 Addenda, and 2000 Addenda) as acceptable alternatives to the requirements of the 1995 Edition up to and including the 1996 Addenda of the ASME Code, Section XI, referenced in the GALL AMPS without the need to submit these alternatives for NRC review in its plant-specific license renewal application.
>
> The new limitations and modifications in 10 CFR 50.55a(b) require that the revised provisions be supplemented with additional inspection requirements as a condition for their use. The conclusions of the GALL report remain valid for the 1997 Addenda, 1998 Edition, 1999 Addenda, and 2000 Addenda of Section XI of the BPV Code with the use of these new limitations and modifications as discussed in this final rulemaking.

On the basis that this alternative, as it relates to repair and replacement, has already been generically reviewed and approved by the NRC staff for aging management of systems and components within the scope of license renewal, the project team concluded that this item does not need to be classified as an exception, and that with regard to this item, the program element affected by it is consistent with the GALL Report.

### 2.8.4 Enhancement

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

| | |
|---|---|
| Element: | 3: Parameters Monitored/Inspected |
| Element: | 4: Detection of Aging Effects |
| Element: | 5: Monitoring and Trending |
| Enhancement: | The BWR Feedwater Nozzle Program will be enhanced by including the recommendations of General Electric (GE) NE-523-A71-0594, Revision 1, “Alternate BWR Feedwater Nozzle Inspection Requirement.” |

The GALL Report identifies the following recommendations for “parameters monitored/inspected,”“detection of aging effects,” and “monitoring and trending” program elements associated with the enhancement:

> The aging management program (AMP) monitors the effects of cracking on the intended function of the component by detection and sizing of cracks by ISI in accordance with ASME Section XI, Subsection IWB and the recommendation of GE NE-523-A71-0594, as described below.
>
> The extent and schedule of the inspection prescribed by the program are designed to ensure that aging effects will be discovered and repaired before the loss of intended function of the component. Inspection can reveal crack initiation and growth. The GE NE-523-A71-0594 specifies ultrasonic testing (UT) of specific regions of the blend radius and bore. The UT examination techniques and personnel qualifications are in accordance with the guidelines of GE NE-523-A71-0594. Based on the inspection method and techniques and plant-specific fracture mechanics assessments, the inspection schedule is in accordance with Table 6-1 of GE NE-523-A71-0594. Leakage monitoring may be used to modify the inspection interval.
>
> Inspections scheduled in accordance with GE NE-523-A71-0594 provides timely detection of cracks.

By letter dated September 24, 1999, the BWR Owners Group (BWROG) submitted for NRC staff review Topical Report GE-NE-523-A71-0594, Revision 1, "Alternate BWR Feedwater Nozzle Inspection Requirements." This report proposed an alternative to the recommendations set forth in NUREG-0619, "BWR Feedwater Nozzle and Control Rod Return Drain Line Nozzle Cracking." The topical report made the following proposals: (1) accept the UT as the basis to eliminate supplemental liquid penetrant testing of the inside radius of the reactor pressure vessel (RPV) nozzles, (2) lengthen the time interval between routine UT of the inside radius of the RPV nozzles, and (3) reduce the inspection area of the inside radius of the RPV nozzles. In its review of the topical report, the staff focused on the quality and reliability of the ultrasonic examinations. In a letter to BWROG, dated March 10, 2000 (ML003690673), the staff approved the proposed inspection program and schedule as described in the BWROG topical report. Therefore, GE-NE-523-A71-0594, Revision 1, is an acceptable alternative to the inspection guidelines in NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Cracking."

The applicant stated that, it made four long-term inspection commitments based on NUREG-0619 in 1989. The four commitments were as follows:

1. Review on-line feedwater nozzle thermal sleeve leak detection system data on a monthly basis.
2. Perform external UT examinations on two of the four feedwater nozzles each refueling outage.
3. Perform visual inspections of the spargers and the nozzle blend radius area of all four feedwater nozzles each refueling outage.
4. Perform PT examinations of nozzles at the next appropriate opportunity in the event that: a) UT examinations indicate a flaw or b) Excessive leakage (greater than 0.3 gpm) is identified by the on-line leakage monitoring systems.

In the corresponding NRC Safety Evaluation Report (SER), the NRC stated that MNGP would continue inspections for "9 Inspection Interval-Refueling Cycles or 135 Startup/Shutdown Cycles" as stated in NUREG-0619. The inspection interval began with the installation of welded thermal sleeves during the 1981 refueling outage. With the completion of inspections during the 1998 refueling outage, MNGP completed the required 9 Inspection Interval-Refuelng Cycles with no observed degradation of the feedwater nozzles. The most recent feedwater nozzle inspections conducted during the 3rd 10-year ASME Section XI Inservice Inspection Program (ending on May 1, 2003) also revealed no cracking on these nozzles.

During the audit and review, the project team asked the applicant to clarify how MNGP plans to update its current BWR Feedwater Nozzle program to meet the recommendations specified in General Electric (GE) NE-523-A71-0594, Revision 1. The applicant stated that: (1) the requirement specified in ASME Section XI Table IWB-2500-1, Examination Category B-D, for full penetration welded nozzles have been incorporated into the MNGP BWR Feedwater Nozzle program; (2) the region being inspected, examination techniques, and personnel qualifications will be consistent with the recommendations of GE NE-523-A71-0594, Revision 1, Section 4.0; and (3) the requirement of ASME XI with Appendix VIII, including the schedule requirements of IWB-2400, have been incorporated into the MNGP BWR Feedwater Nozzle Program, which will be enhanced to be consistent with the recommendations of GE NE-523-A71-0594, Revision 1, Sections 6.2 and 6.3. If defects are detected, the scope of examinations is expanded per the requirements of IWB-2430. The project team determined that this enhancement is acceptable because the associated recommendations are based on (1) the availability of the proven improved UT techniques, (2) MNGP's meeting the inspection commitments made in 1989, (3) its acceptable performance history of the feedwater nozzles with the new thermal sleeves, and (4) NRC staff's approval of using GE-NE-523-A71-0594, Revision 1.

The applicant states that this enhancement is scheduled for implementation prior to the period of extended operation and is listed as commitments# 18, 19, and 20, respectively, in Appendix A.5, "Commitments" of the MNGP License Renewal Application.

On the basis of its review of the above enhancement and discussions with the applicant's technical staff, 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.

### 2.8.5 Operating Experience

The applicant states, in the MNGP LRA, that the inspection and testing methodologies of the BWR Feedwater Nozzle program have been effective in detecting aging effects due to cracking. Engineering evaluations were performed based on plant and industry experience and component and programmatic corrective actions implemented as required. For example:

- Repairs were made to the feedwater nozzles and safe ends in 1977 to minimize damage to the feedwater nozzles due to thermal cycling. Cladding was removed from the nozzle blend radius and bore, and a feedwater sparger interference fit thermal sleeve with a piston ring seal was installed.

- New feedwater nozzle safe ends were installed in 1981. These safe ends have a tuning fork design with a welded-in thermal sleeve and provide a significant reduction in thermal cycling.

- NUREG-0619, along with NRC Generic Letter 81-11 considerations, was incorporated into the BWR Feedwater Nozzle Program during the third 10-Year inspection interval ending on May 1, 2003. No cracking was identified as a result of these inspections.

The applicant stated that, since the completion of feedwater nozzle modifications in 1981, it has completed extensive feedwater nozzle inspections with no cracking detected. The project team noted that MNGP management also provided oversight on the MNGP Feedwater Nozzle program, as this was evidenced in the management review of the feedwater nozzle inspection results which were documented in the ISI summary report during Cycle 21 and Refueling Outage 21.

The project team reviewed the operating experience provided in MNGP 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 operating experience and discussions with the applicant's technical staff, the project team concludes that the applicant’s AMP B.2.1.8 will adequately manage the aging effects that are identified in MNGP LRA for which this AMP is credited.

2.8.6 USAR Supplement

The applicant provides its USAR Supplement for the BWR Feedwater Nozzle program in a letter dated June 10, 2005, Enclosure 2, Appendix A, Section A2.1.8, which states that the MNGP program is part of the MNGP ASME Section XI Inservice Inspection Program. The BWR Feedwater Nozzle program is in accordance with ASME Section XI 1995 Edition through the 1996 Addenda with Appendix VIII. The program provides for condition monitoring of the BWR feedwater nozzles. The BWR feedwater nozzles were all repaired in 1977, and the safe ends were all replaced in 1981 with a tuning fork design with a welded-in thermal sleeve.

The BWR Feedwater Nozzle Program is not currently augmented by the recommendations of General Electric (GE) NE-523-A71-0594, Alternate BWR Feedwater Nozzle Inspection Requirement. The program will be enhanced by including the recommendations of the GE NE-523-A71-0594-A, Revision 1.

The Program is updated periodically as required by 10 CFR 50.55a.

Section A2.1.5 also states that prior to the period of extended operation, the BWR Feedwater Nozzle Program will be enhanced so:
1) The parameters monitored and inspected are consistent with the recommendations of GE NE-523-A71-0594-A, Revision 1.
2) The regions being inspected, examination techniques, personnel qualifications, and inspection schedule are consistent with the recommendations of GE NE-523-A71-0594-A, Revision 1.

3) That inspections will be scheduled per recommendations of GE NE-523-A71-0594-A, Revision 1.

The project team reviewed the USAR Supplement for MNGP 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).

#### 2.8.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team finds that those program elements for which the applicant claimed consistency with the GALL 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 aging management program being consistent with the GALL Report 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 USAR 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 BWR PENETRATIONS (MNGP AMP B2.1.9)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.9, "BWR Penetrations," is an existing plant program that is consistent with GALL AMP XI.M8, "BWR Penetrations," with exceptions.

#### 2.9.1 Program Description

The applicant states, in the MNGP LRA, that this program is part of the MNGP ASME Section XI Inservice Inspection Program and that the BWR Penetrations program is "in accordance with ASME Section XI 1995 Edition through the 1996 Addenda (with approved ISI relief requests)" and provides for condition monitoring of the BWR penetrations.

The applicant also states that the BWR water chemistry is controlled per the EPRI guidelines of BWRVIP-130 (TR-1008192) BWR Water Chemistry Guidelines - 2004 Revision and that BWRVIP-130 supersedes previous revisions of the guidelines, including BWRVIP-29 (TR-103515), BWR Water Chemistry Guidelines - 1993 Revision.

The applicant further states that its program activities incorporate the inspection and evaluation guidelines of BWRVIP-49, BWR Vessel and Internals Project, Instrument Penetration Inspection and Flaw Evaluation Guidelines, for instrument penetrations and BWRVIP-27, BWR Vessel and Internals Project, BWR Standby Liquid Control System/Core Plate DP Inspection and Flaw Evaluation Guidelines, for Standby Liquid Control System. The applicant states that the program is updated periodically as required by 10 CFR 50.55a and the BWRVIP.

### 2.9.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.9 is consistent with GALL AMP XI.M8, with exceptions.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.9, including PBD/AMP-039, Revision 1, “Aging Management Program Basis Document - BWR Penetrations," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M8. The project team also reviewed the applicant’s documents EWI-08.01.01, “Boiling Water Reactor Vessel Internals Project Administrative Manual,” Revision 4; EWI-08.01.02, “BWRVIP Implementation Guidelines,” Revision 1; AWI-09.04.03, “Administrative Work Instruction - ASME Section XI Repair/ Replacement Program, Revision 8; and PEI-02.08.03, “Inservice Inspection Flaw Evaluation,” Revision 0.

During the audit and review, the project team noted that the applicant’s program description in the MNGP LRA states that MNGP’s BWR Penetrations program is “in accordance with ASME Section XI 1995 Edition through 1996 Addenda (with approved ISI relief requests).” The project team asked the applicant to clarify the intention of the parenthetic phrase “with approved ISI relief requests” in the LRA program description. In its response, the applicant states that relief requests were mentioned in the LRA because they are part of the current MNGP ASME Section XI programs that are credited with managing aging effects. The applicant further stated that relief requests were not considered to be exceptions to NUREG-1801 because they are temporary in nature and, in many cases, expire prior to the period of extended operation. The applicant stated that code cases and relief requests of the MNGP ASME Section XI Inservice Inspection, Subsections IWB, IWC, IWD, and IWF are valid for approximately 21 months into the period of extended operation and that the current inspection interval ends on May 31, 2012.

The applicant further states that it performed an evaluation of MNGP’s currently approved ASME Section XI relief requests and code cases against the program elements of the BWR Penetrations program. The applicant’s evaluation determined that two of MNGP’s currently approved relief requests, one based on Code Case N-613-1 and the other implementing risk-informed inservice inspection (RI-ISI), do affect the “detection of aging effects” program element of the BWR Penetrations Program. The project team’s evaluation of these exceptions is documented in Section 2.9.3 of this audit and review report.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.9 and associated bases documents against the GALL AMP XI.M8 for consistency.

The project team reviewed those portions of the applicant’s BWR Penetrations program for which the applicant claims consistent with GALL AMP XI.M8 and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s BWR Penetrations program provides reasonable assurance that aging effects will be managed so that the system and components within the scope of the program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation. The project team finds the applicant's BWR Penetrations program acceptable because it conforms to the recommended GALL AMP XI.M8, "BWR Penetrations," with the exceptions as described below.

### 2.9.3 Exceptions to the GALL Report

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

Element: 2: Program Description and Preventive Actions
Exception: The MNGP BWR water chemistry is controlled using EPRI BWRVIP-130 (TR-1008192), BWR Water Chemistry Guidelines - 2004 Revision. NUREG-1801, Chapter XI, Program XI.M8 references BWRVIP-29 (TR-103515), BWR Chemistry Guidelines - 1993 Revision.

The GALL Report identifies the following recommendation for the "program description" associated with the exception taken:

> The program includes monitoring and control of reactor coolant water chemistry in accordance with the guidelines of BWRVIP-29 (Electric Power Research [EPRI] TR-103515) to ensure the long-term integrity and safe operation of boiling water reactor (BWR) vessel internal components.

The GALL Report identifies the following recommendation for the "preventive actions" program element associated with the exception taken:

> Maintaining high water purity reduces susceptibility to SCC or IGSCC, and reactor coolant water chemistry is monitored and maintained in accordance with the guidelines in BWRVIP-29 (EPRI TR-103515).

The applicant states, in the MNGP LRA, that reactor water chemistry is monitored and maintained in accordance with the guidelines in BWRVIP-130 (TR-1008192), BWR Water Chemistry Guidelines - 2004 Revision. BWRVIP-130 supersedes previous revisions of the BWR Water Chemistry Guidelines, including BWRVIP-29 (TR-103515) BWR Water Chemistry Guidelines - 1993 Revision. The program description, evaluation, and technical basis of monitoring reactor water chemistry are presented in the MNGP Plant Chemistry Program. The applicant further states that BWRVIP-130 (TR-1008192) is the current update of the BWR Water Chemistry Guidelines and superseded BWRVIP-79 (TR-103515-R2) [which had superseded BWRVIP-29]. The applicant states that BWRVIP-130 is based on updated industry experience, with increased emphasis on fuel performance concerns, while retaining chemistry parameters, action levels and associated measurement frequencies essentially unchanged. The project team's evaluation of the applicant's plant chemistry program is documented in Section 2.25 of this audit and review report. The project team determined that the applicant's use of a more recent BWRVIP document, rather than the specific BWRVIP document identified in the GALL Report, is an acceptable exception to the GALL Report.

The applicant states, in the MNGP LRA, that its BWR Penetrations program is "in accordance with ASME Section XI 1995 Edition through 1996 Addenda (with approved ISI relief requests)." During the audit and review, the project team asked the applicant whether its current approved ISI relief requests or code cases affect any of the elements of its aging management programs. In a letter dated August 31, 2005 (ML052500294), the applicant identified the following additional exception to the GALL Report program elements:

> Element: 4: Detection of Aging Effects
> Exception: MNGP's BWR Penetrations Program will deviate from the requirements of ASME Section XI, Table IWB–2500-1 and Figure IWB-2500s-7(b) with regard to the examination volume for Category B-D components.

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

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

In its evaluation of the effects of current approved ISI relief requests and code cases, the applicant identified that during the current ISI inspection interval, which will extend approximately 21 months into the period of extended operation, examination of Category B-D components (Full Penetration Welded Nozzles in Vessels) will deviate from the requirements of ASME Section XI, Table IWB-2500-1, Item No B3.90, and from the requirements of ASME Section XI, Figure IWB-2500-7(b). Specifically, Figure IWB-2500-7(b) requires that a minimum volume of material equal to a distance of one-half the reactor vessel shell thickness (i.e., a distance of approximately 2-1/2 inches) be included in the examination volume on each side of the weld; however, the BWR Penetrations program at MNGP will, instead, include a reduced examination volume of one-half inch of base metal on each side of the widest portion of the weld. The applicant identified this reduction in weld examination volume as an exception to the recommendations of GALL AMP XI.M8. The applicant has provided the following discussion as technical justification for the reduction in examination volume:

> The examination volume required by ASME Section XI, Figure IWB-2500-7(b) extends far beyond the weld into the base metal on each side of the widest portion of the weld and is unnecessarily large. The alternative re-defined the examination volume boundary to 1/2-inch of base metal on each side of the widest portion of the weld, removing from examination the base metal that was extensively examined during prior inspections and that is not in the high residual stress region associated with the weld. Creation of flaws in the volume excluded from the reduced examination is unlikely because of the low stress in the base metal away from the weld. The stresses caused by welding are concentrated at

> or near the weld. Cracks, should they initiate, occur in the high stressed areas of the weld. These high-stress areas are contained in the volume that is defined by Code Case N-613-1 and are thus subject to examination. During the previous examinations, no indications exceeding the allowable limits of the preservice or inservice criteria were found in the reactor vessel nozzle to shell examination volumes including the base metal areas that will be excluded from examination by reduction of the previously used examination volume.

In its letter dated August 31, 2005 (ML052500294), the applicant states that it considers the alternative examination of Category B-D welds based on Code Case N-613-1 to be an exception to the "detection of aging effects" program element as described in GALL AMP XI.M8. The project team reviewed the applicant's description and technical justification for this exception as summarized in the preceding paragraph. The project team also reviewed applicant's letter to the NRC dated February 27, 2004, "Request for Authorization to Utilize Code Case N-613-1" (ML040610545), which provides a similar technical discussion and includes tables of previous examination results. On the basis that the examination volume includes the heat-affected regions of base metal around the welds where new cracks are most likely to occur and that previous examinations of the base metal beyond the heat-affected regions have not detected any unacceptable indications, the project team concludes that this exception is acceptable.

During the audit and review, the project team noted that in the "Detection of Aging Effects" program element the applicant refers parenthetically to "risk-informed ISI." Specifically, the first sentence of the "Detection of Aging Effects" program element reads as follows:

> The detection of aging effects is prescribed by the MNGP BWR Penetrations Program in accordance with the requirements of ASME Section XI, Table IWB-2500-1 for Examination Categories B-D, B-O and B-W and NRC approved alternatives for Categories B-F and B-J (risk-informed ISI [RI-ISI]).

The project team asked the applicant to address the effects of its risk-informed ISI associated with the detection of aging effects" program element.

In a letter dated August 31, 2005, the applicant stated that MNGP's implementation of risk-informed ISI affects the "Detection of Aging Effects" program element of MNGP's BWR Penetrations program and is an exception to GALL AMP XI.M8.

> Element: 4: Detection of Aging Effects
> Exception: MNGP's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program will include a risk-informed ISI methodology that provides an alternative to the ASME Section XI inservice inspection requirements with regards to (1) the number of locations inspected, (2) the locations inspected, and (3) the method of inspection. This alternative is applicable for welds in ASME Section XI categories B-F (Class 1 pressure retaining dissimilar metal welds in vessel nozzles), B-J (Class 1 pressure retaining welds in piping), C-F-1 (Class 2 pressure retaining welds in austenitic stainless steel or high-alloy piping), and C-F-2 (Class 2 pressure retaining welds in carbon or low-alloy steel piping).

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

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

In its letter dated August 31, 2005 (ML052500294), the applicant stated that its implementation of risk-informed ISI during the current inspection interval affects both GALL AMP XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” and GALL AMP XI.M8, “BWR Penetrations.” The project team’s evaluation of this exception for GALL AMP XI.M1 is documented under discussion of <u>Exception 7</u> in Section 2.2.3 of this audit and review report. The same discussion is applicable for evaluation of this exception with regard to GALL AMP XI.M8. Based on the discussion documented in Section 2.2.3 of this audit and review report, the project team concludes that the applicant’s implementation of risk-informed ISI is an acceptable exception to the “Detection of Aging Effects” program element as described in GALL AMP XI.M8, “BWR Penetrations.”

On the basis of the review of the above exceptions and the review of operating experience for the MNGP AMP B2.1.9 program (see Section 2.9.5, below), the project team finds these exceptions to be acceptable.

### 2.9.4 <u>Enhancements</u>

None

### 2.9.5 <u>Operating Experience</u>

The applicant states, in the MNGP LRA, that the BWR Penetrations program has been effective in managing aging effects of materials susceptible to crack initiation and growth. The applicant states that materials within the scope of the program are periodically examined and evaluated for corrective action as needed and that vendor guidance (e.g., BWRVIP-49 and 27) has been incorporated into the program. The applicant states that corrective actions to replace materials susceptible to cracking have been implemented and cites specific examples of such replacements.

The applicant further states that results of prior NRC inspections, INPO evaluations, audits, and self-assessments indicate an effective program has been established and is demonstrated by the actions taken to date to address and replace where needed age-susceptible materials

During the audit, the project team noted that the standby liquid control (SLC) nozzle safe end and the jet pump instrument nozzle safe end and penetration seals were replaced in 1984. The project team asked the applicant whether cracking in these components had been detected prior to their replacement. In response to this question, the applicant stated that the replacements of the jet pump instrument nozzle safe-end, SLC nozzle safe end, and the penetration seals were completed as a preventive measure, not for cracking issues. The applicant further stated that there has been no cracking detected since the replacement. On the basis that the replacements had been done as a preventive measure, not because cracking had been detected, the project team concluded that the applicant's response was satisfactory.

On the basis of its evaluation of the applicant's program against the GALL Report's recommendations, its review of the above industry and plant-specific operating experience, and its discussions with the applicant's technical staff, the project team concludes that the applicant's BWR Penetrations program will adequately manage the aging effects that are identified in MNGP LRA for which this AMP is credited.

2.9.6 USAR Supplement

The applicant provides its USAR Supplement for the BWR Penetrations Program in the MNGP LRA, Appendix A, Section 2.1.9. which states that the MNGP program is part of the MNGP ASME Section XI Inservice Inspection Program and that the BWR Penetrations program is in accordance with ASME Section XI 1995 Edition through the 1996 Addenda (with approved ISI relief requests) and provides for condition monitoring of the BWR penetrations.

The USAR Supplement further states that the BWR water chemistry is controlled per the EPRI guidelines of BWRVIP-130 (TR-1008192) BWR Water Chemistry Guidelines - 2004 Revision. The USAR Supplement states that BWRVIP-130 supersedes previous revisions of the guidelines including BWRVIP-29 (TR-103515), BWR Water Chemistry Guidelines - 1993 Revision.

The USAR Supplement states that program activities incorporate the inspection and evaluation guidelines of BWRVIP-49, BWR Vessel and Internals Project, Instrument Penetration Inspection and Flaw Evaluation Guidelines, for instrument penetrations and BWRVIP-27, BWR Vessel and Internals Project, BWR Standby Liquid Control System/Core Plate DP Inspection and Flaw Evaluation Guidelines, for Standby Liquid Control System. The USAR Supplement also states that the program is updated periodically as required by 10 CFR 50.55a and the BWRVIP.

The project team noted that this USAR Supplement includes parenthetic mention of "approved ISI relief requests." In its letter dated August 31, 2005, the applicant states that reference to ISI relief requests will be deleted from the USAR Supplemental description of the BWR Penetrations program.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.9, found that it was consistent with the GALL Report, and determined that, with deletion of the reference to ISI relief requests, 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 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 program are consistent with the GALL Report program. In addition, the project team has reviewed the exceptions and the associated justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3). The project team also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.10 BWR STRESS CORROSION CRACKING (MNGP AMP B2.1.10)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.10, "BWR Stress Corrosion Cracking," is an existing plant program that is consistent with GALL AMP XI.M7, "BWR Stress Corrosion Cracking," with exceptions.

### 2.10.1 Program Description

The applicant states, in the MNGP LRA, that this program is an existing program and is part of the MNGP ASME Section XI Inservice Inspection Program. The applicant states that ASME Section XI is being implemented "with ultrasonic (UT) volumetric, surface, and visual inspections and risk-informed ISI." The applicant also states that NUREG-0313, "Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping," and Nuclear Regulatory Commission (NRC) Generic Letter (GL) 88-01, "NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping," and its Supplement 1 are part of the MNGP BWR Stress Corrosion Cracking Program. The applicant further states that all intergranular stress corrosion cracking (IGSCC) susceptible materials have been replaced or protected with a cladding of resistant weld material and that, therefore, all piping welds are now classified as IGSCC Category A in accordance with NUREG-0313 and GL 88-01. The applicant states that as part of the MNGP recirculation piping replacement effort, austenitic stainless steel portions of piping systems 4" in nominal diameter or larger operating at temperatures above 200 /F of the reactor coolant pressure boundary were replaced in accordance with the requirements of NUREG-0313.

The applicant states that a hydrogen water chemistry system was placed in operation which reduces the oxidizing environment by introducing excess hydrogen to the reactor coolant system that combines with the free oxygen produced by radiolysis.

### 2.10.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.10 is consistent with GALL AMP XI.M7, with exceptions.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.10, including PBD/AMP-038, Revision 2, "Aging Management Program Basis Document - BWR Stress Corrosion Cracking," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M7. The project team also reviewed the applicant's documents PEI-02.08.03, "Inservice

Inspection Flaw Evaluation," Revision 0; DBD-T.12, "Design Basis Document - Plant Piping, " Revision D; and EWI-09.04.00, "Engineering Work Instruction - ASME Section XI Inservice Inspection Program."

During the audit and review, the project team noted in the MNGP LRA that the applicant's program description states that its BWR Stress Corrosion Cracking program is part of the MNGP ASME Section XI Inservice Inspection program and that the ASME Section XI is being implemented "with ultrasonic (UT) volumetric, surface, and visual inspections and the risk-informed ISI Program." The project team asked the applicant to address the effects of its risk-informed ISI and other currently approved ISI relief requests associated with the LRA program description.

The applicant states that relief requests, including risk-informed ISI, were mentioned in the LRA because they are part of the current MNGP ASME Section XI programs that are credited with managing aging effects. The applicant further stated that relief requests were not considered to be exceptions to NUREG-1801 because they are temporary in nature and, in many cases, expire prior to the period of extended operation. The applicant stated that code cases and relief requests of the MNGP ASME Section XI Inservice Inspection, Subsections IWB, IWC, IWD, and IWF are valid for approximately 21 months into the period of extended operation and that the current inspection interval ends on May 31, 2012. In addition, the applicant determined that, except for one difference related to the "corrective action" program element, MNGP's implementation of risk-informed ISI and currently approved relief requests do not affect any of the program elements of MNGP's BWR Stress Corrosion Cracking program. Consequently, as documented in a letter dated August 31, 2005 (ML052500294), the applicant states that the MNGP LRA will be revised to delete all references to the risk-informed ISI program in the description of MNGP's BWR Stress Corrosion Cracking program.

The project team reviewed the applicant's BWR Stress Corrosion Cracking Program and additional descriptions of MNGP's risk-informed ISI program contained in applicant's letter dated December 18, 2001, "Alternative to the ASME Boiler and Pressure Vessel Code Section XI Requirements for Class 1 and 2 Piping Welds – Risk Informed Inservice Inspection Program," (ML020240381). On the basis of its review, the project team concludes that MNGP's risk-informed ISI program and approved ISI relief requests do not affect any of MNGP's BWR Stress Corrosion Cracking Program elements. The project team also finds that the applicant's change to delete all references to the risk-informed ISI program in the description of MNGP's BWR Stress Corrosion Cracking Program is acceptable.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.10 and associated bases documents against the GALL AMP XI.M7 for consistency. As a result of its evaluation of ISI relief requests, the applicant identified one ISI relief request as an exception to the "corrective action" element of the BWR Stress Corrosion Cracking program. The project team's evaluation of that exception is provided in Section 2.3.3 of the audit and review report.

The project team reviewed those portions of the applicant's BWR Stress Corrosion Cracking Program for which the applicant claims consistent with GALL AMP XI.M7 and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's BWR Stress Corrosion Cracking Program provides reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.  The project team finds the applicant's BWR Stress Corrosion Cracking Program acceptable because it conforms to the recommended GALL AMP XI.M7, "BWR Stress Corrosion Cracking," with the exceptions as described below.

2.10.3 Exceptions to the GALL Report

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

> Element: 2: Preventive Actions
> Exception: The BWR water chemistry is controlled using BWRVIP-130 (EPRI TR-1008192), BWR Water Chemistry Guidelines - 2004 Revision. BWRVIP-130 supersedes previous revisions of the BWR Water Chemistry Guidelines, including BWRVIP-29 (TR-103515), which is referenced in NUREG-1801.

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

> The program delineated in NUREG-0313 and NRC GL 88-01 does not provide specific guidelines for controlling reactor water chemistry to mitigate IGSCC; however, maintaining high water purity reduces susceptibility to SCC or IGSCC, and reactor coolant water chemistry is monitored and maintained in accordance with the guidelines in BWRVIP-29 (Electric Power Institute [EPRI] TR-103515).

The applicant states, in the MNGP LRA, that reactor coolant water chemistry is monitored and maintained in accordance with the guidelines in BWRVIP-130 (TR-1008192), BWR Water Chemistry Guidelines - 2004 Revision.  BWRVIP-130 supersedes previous revisions of the BWR Water Chemistry Guidelines, including BWRVIP-29 (TR-103515) BWR Water Chemistry Guidelines - 1993 Revision.  The program description, evaluation, and technical basis of monitoring reactor water chemistry are presented in the MNGP Plant Chemistry Program.  The applicant further states that BWRVIP-130 (TR-1008192) is the current update of the BWR Water Chemistry Guidelines and superseded BWRVIP-79 (TR-103515-R2)  [which had superseded BWRVIP-29].  The applicant states that BWRVIP-130 is based on updated industry experience, with increased emphasis on fuel performance concerns, while retaining chemistry parameters, action levels, and associated measurement frequencies essentially unchanged.

The project team's evaluation of the applicant's plant chemistry program is documented in Section 2.25 of this audit and review report.  The project team determined that the applicant's use of a more recent BWRVIP document, rather than the specific BWRVIP document identified in the GALL Report, is an acceptable exception to the GALL Report.

During the audit and review, the project team asked the applicant whether its current approved ISI relief requests or code cases affect any of the elements of its aging management programs. In a letter dated August 31, 2005 (ML052500294), the applicant identified the following additional exception to the GALL Report program elements:

Element: 7. Corrective Actions
Exception: An approved alternative allows the use of the 2001 Edition of ASME Section XI in lieu of the 1995 Edition with the 1996 Addenda for repair/ replacement activities.

The GALL Report Identifies the following recommendations for the “corrective action” program element associated with the exception taken:

> The guidance for weld overlay repair and stress improvement or replacement is provided in NRC GL 88-01; ASME Section XI, Subsections IWB-4000 and IWB-7000, IWC-4000 and IWC-7000, or IWD-4000 and IWD-7000, respectively, for Class 1, 2, or 3 components; and ASME Code Case 504-1.

The applicant states that the alternative [to use the 2001 Edition of ASME Section X for repair/ replacement] has already been generically reviewed and approved by the NRC staff for aging management of systems and components within the scope of license renewal and that therefore this alternative will not affect the aging management of components crediting ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD. The applicant provides the following text and states that it was published in the *Federal Register*/Volume 67, No. 187/Thursday, September 26, 2002/Rules and Regulations:

> Accordingly, an applicant may use Subsections IWB, IWC, IWD, IWE, IWF, and IWL of the ASME BPV Code (1997 Addenda, 1998 Edition, 1999 Addenda, and 2000 Addenda) as acceptable alternatives to the requirements of the 1995 Edition up to and including the 1996 Addenda of the ASME Code, Section Xi, referenced in the GALL AMPS without the need to submit these alternatives for NRC review in its plant-specific license renewal application.
>
> The new limitations and modifications in 10 CFR 50.55a(b) require that the revised provisions be supplemented with additional inspection requirements as a condition for their use. The conclusions of the GALL Report remain valid for the 1997 Addenda, 1998 Edition, 1999 Addenda, and 2000 Addenda of Section XI of the BPV Code with the use of these new limitations and modifications as discussed in this final rulemaking.

On the basis that this alternative, as it relates to repair and replacement, has already been generically reviewed and approved by the NRC staff for aging management of systems and components within the scope of license renewal, the project team concluded that this item does not need to be classified as an exception and that with regard to this item, the program element affected by it is consistent with the GALL Report.

2.10.4 Enhancements

None

2.10.5 Operating Experience

The applicant states, in the MNGP LRA, that a review of plant operating experience for the BWR Stress Corrosion Cracking program identified no adverse trends or issues with program performance and that problems were identified and corrected prior to causing any significant impact to safe operation and adequate corrective actions were taken to prevent recurrence. The applicant further states that the BWR Stress Corrosion Cracking program effectively detects flaw indications in susceptible components and contains appropriate guidance for evaluation of repair of flaws and that, as needed, the inspection plan can be adjusted based on results to enhance program effectiveness.

The applicant states that periodic self-assessments of the program and reviews of industry and plant experience are performed to identify any needed improvements and that the program has been effective in managing aging effects due to stress corrosion cracking and implementing corrective actions (such as installation of materials less susceptible to BWR stress corrosion cracking).

During the audit and review, the project team noted that the applicant states that all IGSCC susceptible material has been replaced or protected with a cladding of resistant weld material. The project team asked what the frequency of inspection is for welds that are classified as Category A per requirements of NUREG-0313. In response, the applicant states:

> The BWR Stress Corrosion Cracking AMP is applicable to all BWR piping made of austenitic stainless steel that is 4 inches or larger in nominal diameter and contains reactor coolant at a temperature above 93 deg-C (200 deg-F) during power operation, regardless of code classification. GL88-01 requires an augmented ASME Section XI ISI Program to inspect welds that are not classified as Category A. All piping welds at Monticello are now classified as IGSCC Category A in accordance with NUREG-0313 and GL 88-01, and the augmented ASME Section XI ISI inspection frequency of GL 88-01 no longer applies to any welds.

On the basis that all piping welds at MNGP are now classified as IGSCC Category A and that the augmented ASME Section XI inservice inspection frequency of GL 88-01 is not applicable, the project team finds the applicant’s response acceptable.

On the basis of its evaluation of the applicant’s program against the GALL Report’s recommendations, its review of the above industry and plant-specific operating experience, and its discussions with the applicant's technical staff, the project team concludes that the applicant’s BWR Stress Corrosion Cracking program will adequately manage the aging effects that are identified in MNGP LRA for which this AMP is credited.

2.10.6 USAR Supplement

The applicant provides its USAR Supplement for the BWR Stress Corrosion Cracking program in the MNGP LRA, Appendix A, Section 2.1.10. which states that the MNGP program is an existing program and is part of MNGP ASME Section XI Inservice Inspection program, and that ASME Section XI is being implemented with ultrasonic (UT) volumetric, surface, and visual inspections and the risk-informed ISI program. The USAR Supplement further states that

NUREG-0313, “Technical Report on Material Selection and Processing Guidelines for BWR Coolant Pressure Boundary Piping, and Nuclear Regulatory (NRC) Generic Letter (GL) 88-01, “NRC Position on IGSCC in BWR Austenitic Stainless Steel Piping,” and its Supplement 1 are part of the MNGP BWR Stress Corrosion Cracking program.

The USAR Supplement states that all IGSCC susceptible materials have been replaced or protected with a cladding of resistant weld material, and therefore all piping welds are now classified as IGSCC Category A in accordance with NUREG-0313 and GL 88-01. The USAR Supplement states that as part of the MNGP recirculation piping replacement effort, austenitic stainless steel portions of piping systems 4 inches in nominal diameter or larger operating at temperatures above 200/F of the reactor coolant pressure boundary were replaced in accordance with the requirements of NUREG-0313.

The USAR Supplement further states that a Hydrogen Water Chemistry System was placed in operation which reduces the oxidizing environment by introducing excess hydrogen to the reactor coolant system that combines with the free oxygen produced by radiolysis.

The project team noted that this USAR Supplement includes the mention of “the risk-informed ISI program,” in the same way as described under the preceding discussion of Consistency with the GALL Report. In its letter dated August 31, 2005, the applicant states that reference to the risk-informed ISI program will be deleted from the USAR Supplement description of the BWR Stress Corrosion Cracking program.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.10, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program as identified in the SRP-LR FSAR supplement table and as required by 10 CFR 54.21(d).

### 2.10.7 Conclusion

On the basis of its review and audit of the applicant’s program, the project team finds that those program elements for which the applicant claimed consistency with the GALL 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 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 USAR 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 BWR VESSEL ID ATTACHMENT WELDS (MNGP AMP B2.1.11)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.11, "BWR Vessel ID Attachment Welds," is an existing plant program that is consistent with GALL AMP XI.M4, “BWR Vessel ID Attachment Welds,” with exceptions.

### 2.11.1 Program Description

The applicant states, in the MNGP LRA, that this program is part of the MNGP ASME Section XI Inservice Inspection Aging Management Program. The applicant also states that the BWR Vessel ID Attachment Weld Program is “in accordance with ASME Section XI 1995 Edition through the 1996 Addenda and approved ISI relief requests.” The program provides for condition monitoring of the BWR vessel ID attachment welds. The program includes inspection and flaw evaluation in accordance with BWRVIP-48, “Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines” (EPRI TR-108724). The applicant further states that MNGP’s water chemistry is controlled per the ERPI guidelines of BWRVIP-130 (TR-1008192), BWR Water Chemistry Guidelines - 2004 Revision. The applicant states that the program is updated periodically as required by 10 CFR 50.55a and that, in addition, the program is supplemented by implementing the guidelines of the Boiling Water Reactor Vessel and Internals Project (BWRVIP).

2.11.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.11 is consistent with GALL AMP XI.M4, with exceptions.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.11, including PBD/AMP-035, “Aging Management Program Basis Document - BWR Vessel ID Attachment Welds," Revision 1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M4. The project team also reviewed the applicant’s document EWI-08.01.01, “Boiling Water Reactor Vessel Internals Project Administrative Manual,” Revision 4, and BWRVIP-48, “Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines,” February 1998.

During the audit and review, the project team noted that in the MNGP LRA the applicant’s program description states that MNGP’s BWR Vessel ID Attachment Welds program is “in accordance with ASME Section XI 1995 Edition through 1996 Addenda and approved ISI relief requests.” The project team asked the applicant to clarify the phrase “approved ISI relief requests.” In response, the applicant states that relief requests were mentioned in the MNGP LRA because they are part of the current MNGP ASME Section XI programs that are credited with managing aging effects. The applicant further states that relief requests were not considered to be exceptions to NUREG-1801 because they are temporary in nature and, in many cases, expire prior to the period of extended operation. The applicant stated that code cases and relief requests of the MNGP ASME Section XI Inservice Inspection, Subsections IWB, IWC, IWD, and IWF are valid for approximately 21 months into the period of extended operation and that the current inspection interval ends on May 31, 2012.

The applicant determined that, except for one difference related to the “corrective action” program element, none of MNGP’s approved ISI relief requests affect any of the program elements of MNGP’s BWR Vessel ID Attachment Welds program. Consequently, as documented in a letter dated August, 31, 2005 (ML052500294), the applicant states that the LRA will be revised to delete all references to ISI relief requests in the description of MNGP’s BWR Vessel ID Attachment Weld program. Upon review of the applicant’s evaluation of program elements against MNGP’s approved relief requests, the project team finds that no approved MNGP ISI relief request affects any of MNGP’s BWR Vessel ID Attachment Welds program elements. On this basis, the project team also finds that the applicant’s change to delete all references to ISI relief requests in the description of MNGP's BWR Vessel ID Attachment Weld program is acceptable.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.11 and associated bases documents against the GALL AMP XI.M4 for consistency. As a result of its evaluation of ISI relief requests, the applicant identified one ISI relief request as an exception to the "corrective action" program element of the BWR Vessel ID Attachment Welds program. The project team's evaluation of that exception is documented in Section 2.3.3 of this audit and review report.

The project team reviewed those portions of the BWR Vessel ID Attachment Welds program for which the applicant claims consistent with GALL AMP XI.M4 and finds that they are consistent the GALL AMP. Furthermore, the project team concludes that the applicant's BWR Vessel ID Attachment Welds program provides reasonable assurance that aging effects for vessel internals will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation. The project team finds the applicant's BWR Vessel ID Attachment Welds program acceptable because it conforms to the recommended GALL AMP XI.M4, "BWR Vessel ID Attachment Welds," with the exceptions as described below.

2.11.3 Exception to the GALL Report

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

| | |
|---|---|
| Element: | 2: Preventive Actions |
| Exception: | The BWR water chemistry is controlled using BWRVIP-130 (TR-1008192), BWR Water Chemistry Guidelines - 2004 Revision. NUREG-1801, Chapter XI, Program XI.M4 references BWRVIP-29 (TR-103515), BWR Water Chemistry Guidelines - 1993 Revision. |

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

> The BWRVIP-48 provides guidance on detection, but does not provide guidance on methods to mitigate cracking. Maintaining high water purity reduces susceptibility to SCC or IGSCC. Reactor coolant water chemistry is monitored and maintained in accordance with the guidelines in BWRVIP-29 (ERPI TR-103515). The program description and evaluation and technical basis of monitoring and maintaining reactor water chemistry are presented in Section XI.M2, "Water Chemistry."

The applicant states, in the MNGP LRA, that reactor water chemistry is monitored and maintained in accordance with the guidelines in BWRVIP-130 (TR-1008192), BWR Water Chemistry Guidelines - 2004 Revision. BWRVIP-130 supersedes previous revisions of the BWR Water Chemistry Guidelines, including BWRVIP-29 (TR-103515) BWR Water Chemistry Guidelines - 1993 Revision. The program description, evaluation, and technical basis of monitoring reactor water chemistry are presented in the MNGP Plant Chemistry Program. The applicant further states that BWRVIP-130 (TR-1008192) is the current update of the BWR Water

Chemistry Guidelines and superseded BWRVIP-79 (TR-103515-R2) [which had superseded BWRVIP-29]. The applicant states that BWRVIP-130 is based on updated industry experience, with increased emphasis on fuel performance concerns, while retaining chemistry parameters, action levels, and associated measurement frequencies essentially unchanged.

The project team's evaluation of the applicant's plant chemistry program is documented in Section 2.25 of this audit and review report. The project team determined that the applicant's use of a more recent BWRVIP document, rather than the specific BWRVIP document identified in the GALL Report, is an acceptable exception to the GALL Report.

During the audit and review, the project team asked the applicant to address its current approved ISI relief requests or code cases affect any of the program elements of its aging management programs. In a letter dated August 31, 2005 (ML052500294), the applicant identified the following additional exception to the GALL Report program elements:

> Element: 7: Corrective Actions
> Exception: An approved alternative allows the use of the 2001 Edition of ASME Section XI in lieu of the 1995 Edition with the 1996 Addenda for repair/ replacement activities.

The GALL Report Identifies the following recommendations for the corrective action program element associated with the exception taken:

> Repair and replacement procedures are equivalent to those requirements in the ASME Section XI. Repair is in conformance with IWB-4000 and replacement occurs according to IWB-7000. As discussed in the appendix to this report, the staff finds that licensee implementation of the guidelines in BWRVIP-48, as modified, will provide an acceptable level of quality for inspection and flaw evaluation of the safety-related components addressed in accordance with 10 CFR Part 50, Appendix B, corrective actions.

The applicant states that the alternative [to use the 2001 Edition of ASME Section XI for repair/ replacement] has already been generically reviewed and approved by the NRC staff for aging management of systems and components within the scope of license renewal and therefore this alternative will not affect the aging management of components crediting ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD. The applicant provides the following text and states that it was published in the *Federal Register*/Volume 67, No. 187/Thursday, September 26, 2002/Rules and Regulations:

> Accordingly, an applicant may use Subsections IWB, IWC, IWD, IWE, IWF, and IWL of the ASME BPV Code (1997 Addenda, 1998 Edition, 1999 Addenda, and 2000 Addenda) as acceptable alternatives to the requirements of the 1995 Edition up to and including the 1996 Addenda of the ASME Code, Section XI, referenced in the GALL AMPS without the need to submit these alternatives for NRC review in its plant-specific license renewal application.
>
> The new limitations and modifications in 10 CFR 50.55a(b) require that the revised provisions be supplemented with additional inspection requirements as a condition for their use. The conclusions of the GALL Report remain valid for

> the 1997 Addenda, 1998 Edition, 1999 Addenda, and 2000 Addenda of Section XI of the BPV Code with the use of these new limitations and modifications as discussed in this final rulemaking.

On the basis that this alternative, as it relates to repair and replacement, has already been generically reviewed and approved by the NRC staff for aging management of systems and components within the scope of license renewal, the project team concludes that this item does not need to be classified as an exception, and that with regard to this item, the program element affected by it is consistent with the GALL Report.

2.11.4 Enhancements

None

2.11.5 Operating Experience

The applicant states, in the MNGP LRA, that the inspection and testing methodologies of the BWR Vessel ID Attachment Welds program have been effective in detecting aging due to cracking and that engineering evaluations were performed based on plant and industry experience and component and programmatic corrective actions implemented as required.

The applicant further states that the BWR Vessel ID Attachment Welds program has detected aging effects and implemented appropriate corrective actions. The applicant states that the program has demonstrated on several occasions that it provides reasonable assurance that aging effects are being managed for reactor vessel interior attachments and that this conclusion is based on a review of past NRC inspection reports, INPO evaluations, audits, and self assessments that noted effectiveness and implementation of corrective actions to improve performance.

The project team reviewed the applicant's operating experience evaluation for the BWR Vessel ID Attachment Welds program and interviewed the applicant's program manager for this program to confirm that plant-specific operating experience did not reveal any degradation not bound by industry experience.

On the basis its evaluation of the applicant's program against the GALL Report's recommendations, its review of the above industry and plant-specific operating experience, and its discussions with the applicant's technical staff, the project team concludes that the applicant's BWR Vessel ID Attachment Welds program will adequately manage the aging effects that are identified in MNGP LRA for which this AMP is credited.

2.11.6 USAR Supplement

The applicant provides its USAR Supplement for the BWR Vessel ID Attachment Welds program in the MNGP LRA, Appendix A, Section 2.1.11. which states that the MNGP program is part of the MNGP ASME Section XI Inservice Inspection program. The BWR Vessel ID Attachment Weld program is in accordance with ASME Section XI 1995 Edition through the 1996 Addends "and approved ISI Relief Requests." The Supplement states that the program provides for condition monitoring of the BWR vessel ID attachment welds and that the program includes inspection and flaw evaluation in accordance with BWRVIP-48, Vessel ID Attachment Weld and Inspection and Flaw Guidelines (EPRI TR-108724).

The USAR Supplement further states that the BWR water chemistry is controlled per the EPRI guidelines of BWRVIP-130 (TR-1008192) BWR Water Chemistry Guidelines - 2004 Revision, and that BWRVIP-130 superseded previous revisions of the guidelines, including BWRVIP-29 (TR-103515, 1993 Revision). The Supplement states that this difference in BWRVIP document number and edition is considered an exception to the NUREG-1801 Program Description.

The USAR Supplement states that the program is updated periodically as required by 10 CFR 50.55a and that in addition the program is supplemented by implementing the guidelines of BWRVIP documents.

The project team noted that this USAR Supplement includes mention of “approved ISI relief requests.” In its letter dated August 31, 2005, the applicant states that reference to ISI relief requests will be deleted from the USAR Supplement description of the BWR Vessel ID Attachment Welds program.

The project team reviewed the USAR Supplement for MNGP 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 USAR 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 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 exceptions and the associated justifications and determined that the AMP with the exceptions is adequate to manage the aging effects for which it is credited. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3). The project team also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.12 BWR VESSEL INTERNALS (MNGP AMP B2.1.12)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.12, "BWR Vessel Internals, "is an existing plant program that is consistent with GALL AMP XI.M9, “BWR Vessel Internals,” with exception and enhancement.

### 2.12.1 Program Description

The applicant states in the MNGP LRA that this program is part of the MNGP ASME Section XI Inservice Inspection Program. The applicant also states that the BWR Vessel Internals Program is “in accordance with ASME Section XI 1995 Edition through the 1996 Addenda and approved ISI relief requests.” The program provides for condition monitoring of the BWR vessel internals for crack initiation and growth. The applicant further states that MNGP activities include the in-vessel examination procedures and the plant water chemistry procedures. The in-vessel examination procedures implement the recommendations of the BWRVIP guidelines as well as the requirements of Section XI of the ASME Boiler and Pressure Vessel Code. The program relies on monitoring and the control of water chemistry to keep peak levels of various contaminants below system-specific limits based on EPRI guidelines of BWRVIP-130 (EPRI-TR-1008192): BWR Water Chemistry Guidelines - 2004 Revision. The applicant states that BWRVIP-130 supersedes previous revisions of the BWR Water Chemistry Guidelines, including BWRVIP-29 (TR-103515, 1993 Revision). The applicant states that the Program is updated periodically as required by 10 CFR 50.55a and the BWRVIP Program.

2.12.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.12 is consistent with GALL AMP XI.M9, with 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 report for MNGP AMP B2.1.12, including PBD/AMP-040, "Aging Management Program Basis Document - BWR Vessel Internals," Revision 1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M9. The project team also reviewed the applicant's documents LR-TR-20, "License Renewal Process Document - Boiling Water Reactor Vessel Internals Project (BWRVIP) Report for MNGP," Revision 0; EWI-08.01.01, "Engineering Work Instruction - BWRVIP Administrative Manual," Revision 2; EWI-08.01.02, "Engineering Work Instruction - BWRVIP Implementation Guidelines," Revision 1; and EWI-08.01.03, "Engineering Work Instruction - Augmented Reactor Vessel Inspections," Revision 2.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.12 and associated bases documents against the GALL AMP XI.M9 for consistency.

During the audit and review, the project team noted that, in the MNGP LRA, the applicant's program description states that MNGP's BWR Vessel Internals program is "in accordance with ASME Section XI 1995 Edition through 1996 Addenda and approved ISI relief requests." The project team asked the applicant to clarify the phrase "and approved ISI relief requests" in the LRA program description. In its letter dated August 11, 2005 (ML052280269), the applicant states that relief requests were mentioned in the LRA because they are part of the current MNGP ASME Section XI programs that are credited with managing aging effects. The applicant further states that relief requests were not considered to be exceptions to NUREG-1801 because they are temporary in nature and, in many cases, expire prior to the period of extended operation. The applicant stated that code cases and relief requests of the MNGP ASME Section XI Inservice Inspection, Subsections IWB, IWC, IWD and IWF are valid for approximately 21 months into the period of extended operation and that the current inspection interval ends on May 31, 2012.

The applicant determined that none of MNGP's approved ISI relief requests affect any of the program elements of MNGP's BWR Vessel Internals program. Consequently, as documented in its letter dated August 11, 2005 (ML052280269), and supplemented by its letter dated August 31, 2005 (ML052500294), the applicant committed to revise the MNGP LRA to delete all references to ISI relief requests in the description of MNGP's BWR Vessel Internals program. Upon review of the applicant's evaluation of program elements against MNGP's approved relief requests, the project team finds that no approved MNGP ISI relief request affects any of MNGP's BWR Vessel Internals program elements. On this basis, the project team also finds that the applicant's change to delete all references to ISI relief requests in the description of MNGP's BWR Vessel Internals program is acceptable.

The project team reviewed those portions of the BWR Vessel Internals Program for which the applicant claims consistent with GALL AMP XI.M9 and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's BWR Vessel Internals program provides reasonable assurance that aging effects for vessel internals will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation. The project team finds the applicant's BWR Vessel Internals program acceptable because it conforms to the recommended GALL AMP XI.M9, "BWR Vessel Internals," with the exception and enhancement as described below.

2.12.3 Exceptions to the GALL Report

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

| | |
|---|---|
| Element: | 2: Preventive Actions |
| Exception: | The BWR water chemistry is controlled using BWRVIP-130 (TR-1008192), BWR Water Chemistry Guidelines - 2004 Revision. NUREG-1801, Chapter XI, Program XI.M9 references BWRVIP-29 (TR-103515), BWR Water Chemistry Guidelines - 1993 Revision. |

The GALL Report identifies the following recommendation for the "preventive actions" program element associated with the exception taken:

> Maintaining high water purity reduces susceptibility to cracking due to SSC or IGSCC. Reactor coolant water chemistry is monitored and maintained in accordance with the guidelines in BWRVIP-29 (EPRI TR-103515). The program description and evaluation, and technical basis of monitoring and maintaining reactor water chemistry are presented in [NUREG-1801] Chapter XI.M2, "Water Chemistry."

The applicant states in the MNGP LRA that MNGP mitigates potential crack initiation and growth through the Plant Chemistry program, MNGP AMP B2.1.25, which mitigates aging effects by controlling the reactor water chemical environment. MNGP AMP B2.1.25 monitors and controls detrimental contaminants such as chlorides, dissolved oxygen, and sulfate concentrations in accordance with MNGP chemistry limits and sampling described in MNGP chemistry procedures and BWRVIP guidelines. The BWR water chemistry is controlled using BWRVIP-130 (TR-1008192): BWR Water Chemistry Guidelines - 2004 Revision. The applicant further states that BWRVIP-130 (TR-1008192) is the current update of the BWR Water Chemistry Guidelines and supersedes BWRVIP-79 (TR-103515-R2) [which had superseded BWRVIP-29]. The applicant states that BWRVIP-130 is based on updated industry experience, with increased emphasis on fuel performance concerns, while retaining chemistry parameters, action levels and associated measurement frequencies essentially unchanged. The project team's evaluation of the applicant's plant chemistry program is documented in Section 2.25 of this audit and review report. The project team determined that the applicant's use of a more recent BWRVIP document, rather than the specific BWRVIP document identified in the GALL Report, is an acceptable exception to the GALL Report.

2.12.4 Enhancements

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

| | |
|---|---|
| Element: | 1: Scope of Program |
| Enhancement: | The repair/replacement guidelines in BWRVIP-16, 19, 44, 45, 50, 51, 52, 57, and 58 will be added, as applicable, to the MNGP BWR Vessel Internals Program. |

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

> The BWRVIP documents provide generic guidelines intended to present the applicable inspection recommendations to assure safety function integrity of the subject safety-related reactor pressure vessel internal components. The various applicable BWRVIP guidelines are as follows:
>
> Core shroud: BWRVIPs -07, -63, and -76; and BWRVIP-02, Rev. 2.
> Core plate: BWRVIP-25; BWRVIP-50.
> Shroud support: BWRVIP-38; BWRVIP-52.
> Low-pressure coolant injection (LPCI) coupling: BWRVIP-42; BWRVIP-56.
> Top guide: BWRVIP-26; BWRVIP-50.
> Core spray: BWRVIP-18; BWRVIP-16 and BWRVIP19.
> Jet pump assembly: BWRVIP-41; BWRVIP-51.
> Control rod drive (CRD) housing: BWRVIP-47; BWRVIP-58.
> Lower plenum: BWRVIP-47; BWRVIP-57.
>
> For each component or assembly, the first listed BWRVIP document provides guidelines for inspection and evaluation, while the second, or last, listed BWRVIP document provides guidelines for repair design criteria.
>
> In addition, BWRVIP-44 provides guidelines for weld repair of nickel alloys; and BWRVIP-45 provides guidelines for weldability of irradiated structural components.

The applicant states in the MNGP LRA that the enhancement is required to satisfy the NUREG-1801 aging management program recommendations and that the enhancement is scheduled for completion prior to the period of extended operation. The project team finds that addition of the listed BWRVIP documents is an appropriate enhancement to the applicant's current program that will result in the applicant's BWR Vessel Internals program being acceptable during the period of extended operation.

During the audit and review, the project team asked the applicant to explain why the BWRVIP documents added by the enhancement were not already included in the applicant's program and whether the applicant had used alternative repair methods different from what is specified in the BWRVIPs. In response, the applicant provided the following statement:

> The reason that the guidelines have not yet been added to the program is that they have not yet been approved by the NRC. Just recently in January 19, 2005, a number of the repair documents were transmitted to the Report Revision Focus Group. These include the NRC SER and will be incorporated into the Monticello BWRVIP Program on an as needed basis once officially issued. There has been no need to use the repair methods in these documents at Monticello. All indications detected have been able to be evaluated using the inspection and evaluation guidelines for the specific components. There have been no alternative methods used in performing repairs after the creation of the BWRVIP. For example, repairs on the Core Spray T-boxes have been completed, but these were completed prior to any BWRVIP document being developed.

The project team reviewed the applicant's response together with the applicant's BWR Vessel Internals program evaluation and implementation documents. On the basis that the applicant has committed to add the applicable BWRVIP requirements into its BWR Vessel Internals program when the documents are approved, and that no alternative methods of repair have been performed after creation of the BWRVIP documents, the project team found the applicant's response acceptable.

The project team asked the applicant how the jet pump nozzle thermal sleeve to safe-end weld will be inspected. In response to this question, the applicant provides the following statement:

> There is currently no inspection technique developed for examining the nozzle thermal sleeve welds (TS-2). The MNGP will continue to monitor the progress of the BWRVIP Committee in the development of the examination technique. It is important to note that this particular region is protected by Hydrogen Water Chemistry and therefore considered to be protected against intergranular stress corrosion cracking. The thermal sleeves are managed for crack initiation and growth due to stress corrosion cracking, intergranular stress corrosion cracking, and irradiation-assisted stress corrosion cracking and credits the BWR Vessel Internals and Plant Chemistry programs for aging management.

Because there currently is no inspection technique for examining the nozzle thermal sleeve welds, the project team considers the applicant's action of monitoring the progress of the BWRVIP Committee in development of the examination technique to be acceptable.

On the basis of its evaluation of the applicant's program against the GALL Report's recommendations and its interviews with the applicant's technical staff as described above, 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.

2.12.5 Operating Experience

The applicant states in the MNGP LRA that its BWR Vessel Internals program is based on inspection requirements contained in plant procedures, which incorporate the requirements of the ASME Code and that the ASME Code inspections are enhanced with inspections requirements consistent with the BWRVIP. The applicant further states that the inspection and testing methodologies have been effective in detecting aging effects due to crack initiation and growth. The applicant provides the following examples of specific inspections and repairs made under its BWR Vessel Internals program:

> In 2003, a UT inspection of the core spray line found cracking in the core spray piping slip joint welds. For this situation, a previous evaluation was determined to bound the current flaw size, and no further action was necessary.
>
> In 1994, mechanical clamps were installed on both of the in-vessel tee box assemblies for the core spray sparger loops A and B. This modification provided a permanent fix that mitigates the crack in the core spray in-vessel lateral header and ensures the core spray system's safety function.
>
> In 1994, visual inspection of the jet pumps during the refueling outage revealed cracking of tack welds on the jet pump restrainer bracket adjusting screws. The cracking was attributed to high cycle fatigue from jet pump vibration. New tack welds were added to the jet pumps restrainer bracket adjusting screws.

The applicant states that the BWR Vessel Internals program has detected aging degradation and implemented appropriate corrective actions. The applicant states that the program has demonstrated on several occasions that it provides reasonable assurance that aging effects are being managed for the BWR vessel internals.

The project team reviewed the applicant's operating experience as provided in the MNGP LRA and in its Aging Management program basis document for the BWR Vessel Internals program. The project team also reviewed the applicant's program implementation documents and interviewed the applicant's program manager for this program.

The project team asked the applicant to confirm MNGP's level of commitment to implementing the BWRVIP guidelines during the period of extended operation. In response, the applicant provided the following description of MNGP's conformance with industry commitments for implementation of the BWRVIP guidelines:

> In a letter dated May 30, 1997, from Carl Terry (Niagara Mohawk Power Company, Chairman of BWR Vessel and Internals Project) to Brian Sheron (NRC), the BWRVIP member utilities commitments were expressed. The letter stated, "We will implement the BWRVIP products at each of our plants as appropriate considering individual plant schedules, configurations and needs." One such document is BWRVIP-94, Program Implementation Guide. BWRVIP-94 states that each member utility, of which Monticello/NMC is, will implement the BWRVIP guidelines to the fullest extent possible.

Based on project team review of the applicant's implementation documents that indicate a very high degree of conformance to BWRVIP guidelines, the project team considers this response to be acceptable.

The project team reviewed the operating experience provided in MNGP 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 evaluation 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 BWR Vessel Internals program will adequately manage the aging effects that are identified in MNGP LRA for which this AMP is credited.

2.12.6 USAR Supplement

The applicant provides its USAR Supplement for the BWR Vessel Internals program in a letter dated June 10, 2005, Enclosure 2, Appendix A, Section A2.1.12. which states that the MNGP program is part of the MNGP ASME Section XI Inservice Inspection Program. The BWR Vessel Internals program is in accordance with ASME Section XI 1995 Edition through the 1996 Addenda “and approved ISI Relief Requests.” The program provides for condition monitoring of the BWR vessel internals for crack initiation and growth. The USAR Supplement further states that MNGP activities include the in-vessel examination procedures and the plant water chemistry procedures and that the in-vessel examination procedures implement the recommendations of the BWRVIP guidelines as well as the requirements of Section XI of the ASME Boiler and Pressure Vessel Code. The program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below system specific limits based on the EPRI guidelines of BWRVIP-130. The program is updated periodically as required by 10 CFR 50.55a and the BWRVIP Program.

The project team noted that this USAR Supplement also includes mention of “approved ISI Relief Requests.” In its letter dated August 31, 2005, the applicant states that reference to ISI relief requests will be deleted from the USAR Supplemental description of the BWR Vessel Internals program.

Section A2.1.12 also states that (1) prior to the period of extended operation, the repair/replacement guidelines in BWRVIP-16, 19, 44, 45, 50, 51, 52, 57, and 58 will be added, as applicable, to the MNGP BWR Vessel Internals Program; and (2) during the period of extended operation, NMC will perform top guide grid inspections using the EVT-1 method of examination, for the high fluence locations (grid beam and beam-to-beam crevice slot locations with fluence exceeding 5 x $10^{20}$ n/$cm^2$ ). Ten percent (10%) of the total population will be inspected within 12 years with a minimum of 5% inspected within the first 6 years.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.12, found that it was consistent with the GALL Report, and determined that, with deletion of the reference to ISI relief requests, 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 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 aging management program being consistent with the GALL Report 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 USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.13 CLOSED-CYCLE COOLING WATER (MNGP AMP B2.1.13)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.13, "Closed-Cycle Cooling Water," is an existing plant program that is consistent with GALL AMP XI.M21, “Closed-Cycle Cooling Water System,” with exceptions and enhancements.

### 2.13.1 Program Description

The applicant states in the MNGP LRA that this program includes (1) preventive measures to minimize corrosion and (2) periodic system and component performance testing and inspection to monitor the effects of corrosion and confirm intended functions are met. Preventive measures include the monitoring and control of corrosion inhibitors and other chemical parameters, such as pH, in accordance with the guidelines of Electric Power Research Institute (EPRI) TR-1008720, Closed Cooling Water Chemistry Guideline (Reference 6); vendor recommendations; and plant operating experience. EPRI TR-1008720 is the current revision (Revision 1) of EPRI-107396. As only minor changes were made to the MNGP Closed-Cycle Cooling Water System program to implement EPRI TR-1008720, the program is also still in accordance with the EPRI Revision 0 guidelines identified in NUREG-1801, Chapter XI, Program M21 (i.e., EPRI TR-107396, Closed Cooling Water Chemistry Guidelines). Periodic inspection and testing to confirm function and monitor corrosion are also performed in accordance with EPRI TR-1008720, vendor recommendations, and industry and plant operating experience. A review of plant operating experience demonstrates these measures ensure closed-cycle cooling water (CCCW) systems are performing their intended functions.

The applicant also states in the MNGP LRA that MNGP has four systems in License Renewal Scope that meet the definition for consideration as closed-cycle cooling water systems and portions of three additional systems (heat exchangers or coolers) that are serviced directly by these cooling water systems. These systems and portions of systems are not subject to significant sources of contamination in which water chemistry is controlled and heat is not directly rejected to a heat sink. The adequacy of chemistry control is confirmed on a routine basis by sampling and monitoring to within established limits and by equipment performance monitoring to identify aging effects.

The applicant also states in the MNGP LRA that corrosion inhibitor concentrations are maintained within limits based on a combination of EPRI TR-1008720 guidelines, vendor recommendations, and plant experience. System and component performance test results are evaluated in accordance with the guidelines of EPRI TR-1008720 and used as a basis for evaluating the effectiveness of actions to mitigate cracking, corrosion, and heat exchanger fouling. Acceptance criteria and tolerances are also based on system design parameters and functions. For chemical parameters monitored, many are based on ranges identical to or more restrictive than noted in both EPRI TR-1008720 and EPRI TR-107396. Others are based on vendor recommendations and plant experience.

The applicant also states in the MNGP LRA that frequency of performance and functional tests are consistent with EPRI TR-1008720 and are based on plant operating experience, trends, and equipment performance. System and component operability tests are typically performed on a more frequent basis than once per cycle whereas more intrusive inspections (disassembly, eddy current testing, etc.) are performed less frequently but at sufficient intervals to detect the impact of aging effects on component function.

2.13.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.13 is consistent with GALL AMP XI.M21, with exceptions and enhancements.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.13, including PBD/AMP-008, “Aging Management Program Basis Document - Closed-Cycle Cooling Water System Program,” Revision 1, 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 report) contained in the MNGP AMP B2.1.13 and associated bases documents against the GALL AMP XI.M21 for consistency.

The project team reviewed those portions of the applicant’s Closed-Cycle Cooling Water program for which the applicant claims consistent with GALL AMP XI.M21 and finds that they are consistent the GALL AMP. Furthermore, the project team concludes that the applicant’s Closed-Cycle Cooling Water program provides reasonable assurance that the aging effects for which the program is credited will be adequately managed. The project team finds the applicant’s Closed-Cycle Cooling Water program acceptable because it conforms to the recommended GALL AMP XI.M21, "Closed-Cycle Cooling Water System," with the exceptions and enhancements as described below.

2.13.3 Exceptions to the GALL Report

The applicant states in the MNGP LRA that the exceptions to the GALL Report elements are as follows.

Exception 1

Element: 1: Scope of Program
Exception: The MNGP Closed-Cycle Cooling Water System program uses EPRI TR-1008720, Closed Cooling Water Chemistry Guideline, (not the NUREG-1801 EPRI TR-107396, Closed Cooling Water Chemistry Guideline). EPRI TR-1008720 is the current revision (Revision 1) of TR-107396.

The GALL Report identifies the following recommendation for the “scope of program” program element associated with the exception taken.

> A CCCW system is defined as part of the service water system that is not subject to significant sources of contamination, in which water chemistry is controlled and in which heat is not directly rejected to a heat sink. The program described in this section applies only to such a system. If one or more of these conditions are not satisfied, the system is to be considered an open-cycle cooling water system. The staff notes that if the adequacy of cooling water chemistry control can not be confirmed, the system is treated as an open-cycle system as indicated in Action III of Generic Letter (GL) 89-13.

The project team reviewed the above exception and decided that it did not address the scope of the program, but that it was more appropriately an exception to parameters monitored or inspected. The GALL Report identifies the following recommendation for the "parameters monitored or inspected" program element associated with the appropriate exception taken.

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

The GALL Report recommends that EPRI TR-107396 be used to monitor for the effects of corrosion, while MNGP uses EPRI TR-1008720, the later revision to the same EPRI technical report. The project team reviewed the standards of EPRI TR-107396 and compared them to EPRI TR-1008720. The project team noticed that these EPRI reports contain both control parameters and diagnostic parameters. EPRI defines control parameters (e.g., pH, conductivity, or corrosion inhibitor concentration) as those that have an immediate effect on corrosion, and their strict adherence is expected. EPRI defines diagnostic parameters as those that provide baseline information on system conditions or that assist in problem troubleshooting, and their adherence is suggested. Deviations from EPRI-recommended diagnostic parameters are not considered to be exceptions to the GALL Report. The changes that EPRI made to TR-1008720 were based on industry experience updated since the original EPRI technical report was issued. The project team noted that the control parameters of the newer EPRI TR-1008720 were either the same as or more conservative than those in the older EPRI TR-107396. On the basis of this comparison, the project team determined that there were no technical concerns associated with the use of EPRI TR-1008720.

The project team questioned the applicant about the above exception to the parameters monitored or inspected program element of the MNGP Closed-Cycle Cooling Water program. The applicant explained that, as noted in the LRA, there are some exceptions to monitoring specific parameters and ranges based on system design and its intended functions for the purposes of license renewal (e.g., freon levels are not monitored as recommended by EPRI because none of the in-scope closed-cycle cooling water systems interfaces with a refrigerant system).

The project team observed that, for each chemical inhibitor type, control parameters are listed in Chapter 5 of EPRI TR-1008720. Normal operating ranges for control parameters, with action levels and monitoring frequencies, are provided. For diagnostic parameters, only monitoring frequencies are specified, with a requirement for the evaluation of trend results. The applicant informed the project team that, for the reactor building closed-cooling water (RBC) system, control parameters are monitored at the frequency recommended in the newer EPRI TR-1008720. For the cooling loops of the emergency diesel generators (DGN) system, monitoring is performed on a quarterly basis, consistent with operability testing frequency of the diesels, which is consistent with the recommendations of the newer EPRI TR-1008720. For the piping and heating coils of the heating and ventilation (HTV) system, chemical parameters and frequencies are not specified in the newer EPRI TR-1008720; however, control parameters are monitored weekly, when the system is in operation. For the closed cooling loop of the #14 air compressor of the instrument and service air (AIR) system, control parameters are measured twice per year, exceeding the annual frequency requirements of the newer EPRI TR-1008720.

Action levels and required response times contained in the newer EPRI TR-1008720 for closed-cycle cooling water systems are not contained in plant procedures. However, the project team determined that plant procedures require the issuance of an action request and evaluation via the MNGP corrective action program for chemistry parameters found outside of limit, and that increased sampling and analysis actions are performed, when required, as part of evaluating corrective action effectiveness. Chemistry procedures also require verification of effectiveness of correction actions.

The applicant states in the MNGP LRA that the additional monitoring techniques and considerations in Chapter 8 of EPRI TR-1008720 are implemented for closed-cycle cooling water systems based on design, license renewal intended function, plant operating experience, and aging effects requiring management. This includes internal component inspections, ultrasonic testing, eddy current testing of heat exchanger tubes, monitoring heat transfer performance, surge tank level monitoring for system leakage, system leak examinations during walk downs and tests, and other system performance monitoring actions.

On the basis of the above review and a review of MNGP operating experience for the AMP B2.1.13 program (see Section 2.13.5, below), the project team finds this exception to be acceptable.

<u>Exception 2</u>

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| Element: | 2: Preventive Actions |
| Exception: | Some of the chemical parameters recommended for routine monitoring by EPRI TR-1008720 and EPRI TR-107396 are not included in the Closed-Cycle Cooling Water System program. Chosen parameters are deemed adequate and based on a combination of system design features (which preclude the need for monitoring some chemicals), make-up water source requirements, EPRI TR-1008720 guidelines, vendor recommendations, and plant operating experience. |

The GALL Report identifies the following recommendation for the “preventive actions” program element associated with the exception taken.

> The program relies on the use of appropriate materials, lining, or coating to protect the underlying metal surfaces and maintenance of system corrosion inhibitor concentrations within specified limits of EPRI TR-107396 to minimize corrosion. The program includes monitoring and control of cooling water chemistry to minimize exposure to aggressive environments and application of corrosion inhibitor in the CCCW system to mitigate general, crevice, and pitting corrosion.

The applicant states in the MNGP LRA that most of the chemical parameters recommended by the GALL Report recommended EPRI TR-1008720 are monitored in the closed-cycle cooling systems. The applicant also states that system design precludes the need to monitor several of these parameters, and operating and inspection activities preclude the need to monitor some others. The project team noted that specific parameters monitored or excluded are noted in the MNGP LRA for the inhibitor type of each closed-cycle cooling water system, and that they are itemized on a parameter basis in the program basis document. Finally, the applicant identified, in each closed-cycle cooling water system, which parameters recommended by the GALL Report recommended EPRI TR-107396 or the GALL Report recommended EPRI TR-1008720 are excluded and the basis for that exclusion, which is as follows.

For the reactor building closed cooling water (RBC) system.

- Conductivity - As noted in both GALL Report recommended EPRI guidelines, conductivity is an indirect measure of concentration of chemical treatment and may also provide indication of system leaks. The applicant does not measure conductivity; however, the applicant does perform direct measurement of the chemical treatment concentration, and the applicant performs continuous leakage detection. After evaluating this information, the project team determined that the applicant is accomplishing the GALL Report recommendations by different means, and finds this to be acceptable.

- Corrosion inhibitor/conductivity ratio - As noted in the GALL Report recommended EPRI guidelines, the corrosion inhibitor/conductivity ratio is helpful in identifying system leaks in nitrite-treated systems. The RBC system is not such a system, but is chromate-based, and so the applicant relies on other effective monitoring methods for identifying leaks, such as surge tank level and system pressures. After evaluating this information, the project team determined that the applicant is accomplishing the GALL Report recommendations by different means, and finds this to be acceptable.

- Chloride - Chloride is monitored and controlled to levels well below the critical concentrations noted in the GALL Report recommended EPRI guidelines. Use of stainless steel in the RBC system is restricted to the residual heat removal (RHR) and reactor recirculation (REC) pump seal coolers and instrument tubing. Chemistry control on the tube side of these coolers includes chemical control for stress corrosion cracking as part of the plant chemistry program; water sources on the tube side include control rod drive hydraulic, reactor coolant, condensate storage tank, and suppression pool (torus) water. As noted in the GALL Report recommended EPRI TR-107396, stress corrosion cracking is minimized with pH > 7.0. For the RBC system, the applicant maintains a pH range of 9.0 to 9.8. Further, the applicant maintains system operating temperature <130F, which is below the threshold at which chloride becomes a concern for stainless steel. After evaluating this information, the project team determined that the applicant is accomplishing the GALL Report recommendations by different means, and finds this to be acceptable.

- Fluoride - Fluoride levels are not monitored; however, makeup water originates from a non-fluoridated source (well water), so fluoride levels are insignificant. In accordance with the GALL Report recommended EPRI TR-107396, fluoride concentrations in closed-cycle cooling water systems are not detrimental to system components, nor do they cause significant stress corrosion cracking. Further, the applicant maintains system operating temperature <130F, which is below the threshold at which fluoride can become a concern for stainless steel. After evaluating this information, the project team determined that the applicant is accomplishing the GALL Report recommendations by different means and finds this to be acceptable.

- Sulfate - Sulfate levels are monitored and controlled to well below the critical concentrations noted in the GALL Report recommended EPRI TR-107396. As noted in the GALL Report recommended EPRI TR-1008720, sulfate contamination comes from poor quality makeup water, service water in-leakage, or biocide additions. These conditions are not present in the MNGP RBC system. After evaluating this information, the project team finds this to be acceptable.

- Iron and Copper - Corrosion products are a direct indication of the presence of corrosion. The applicant does not perform this monitoring for the RBC system. However, the applicant takes actions to inspect and test internal portions of the RBC system to evaluate the occurrence and rate of corrosion (e.g., non-destructive examinations, heat exchanger performance tests, and the proposed one-time inspections). After evaluating this information, the project team determined that the applicant is accomplishing the GALL Report recommendations by different means and finds this to be acceptable.

- Calcium and Magnesium - Calcium and magnesium levels are not monitored. Both the GALL Report recommended EPRI TR-107396 and the GALL Report recommended EPRI TR-1008720 indicate that these parameters should be monitored when raw water makeup is used. Raw water makeup is not used at MNGP; the RBC system is provided with treated water from the demineralized water source for makeup. After evaluating this information, the project team determined that the use of raw water was not an issue at MNGP, finds this to be acceptable.

- Freon - Refrigerant chemicals are not monitored. The system does not interface directly with any refrigerant cooling sources, so freon is not on concern. After evaluating this information, the project team determined that refrigerants are not an issue at MNGP and finds this to be acceptable.

For the cooling loops of the emergency diesel generators (DGN) system.

- Corrosion inhibitor/conductivity ratio - The corrosion inhibitor to conductivity ratio is not calculated or trended; however, both parameters are measured individually and trended. As noted in the GALL Report recommended EPRI guidelines, this is helpful in identifying system leaks, especially in nitrite-treated systems. MNGP systems are not nitrite-treated. System performance monitoring methods are used to detect and to identify leaks. After evaluating this information, the project team determined that the applicant is accomplishing the GALL Report recommendations by different means and finds this to be acceptable.

- Total organic carbon - Total organic carbon is not monitored; however, total aerobic bacteria and sulfate reducing bacteria concentrations are monitored and trended on a periodic basis. After evaluating this information, the project team determined that the applicant is accomplishing the GALL Report recommendations by different means and finds this to be acceptable.

- Dissolved Oxygen - The loops are closed loop, so do not require significant makeup; therefore, dissolved oxygen is not a concern and is not monitored. After evaluating this information, the project team determined that dissolved oxygen is not an issue at MNGP and finds this to be acceptable.

- Fluoride - The loops do not contain stainless steel components, so fluoride is not of concern. After evaluating this information, the project team determined that fluoride is not an issue at MNGP and finds this to be acceptable.

- Sulfate - As with chlorides, sulfate levels are monitored and controlled to well below the critical concentrations noted in the GALL Report recommended EPRI TR-107396. As noted in the GALL Report recommended EPRI TR-1008720, sulfate contamination comes from poor quality makeup water, service water in-leakage, or biocide additions. These conditions are not present in these cooling loops. After evaluating this information, the project team finds this to be acceptable.
- Calcium and magnesium - Calcium and magnesium levels are not monitored. Both the GALL Report recommended EPRI TR-107396 and the GALL Report recommended EPRI TR-1008720 indicate that these parameters should be monitored when raw water makeup is used. Raw water makeup is not used at MNGP, and the loops are provided with treated water from the demineralized water source for makeup, so calcium and magnesium are not of concern. After evaluating this information, the project team determined that the use of raw water is not an issue at MNGP and finds this to be acceptable.

- Freon - Refrigerant chemicals are not monitored. The loops do not interface directly with any refrigerant cooling sources, so freon is not of concern. After evaluating this information, the project team determined that refrigerants are not an issue at MNGP and finds this to be acceptable.

- Radionuclides - Radionuclides are not monitored. The loops do not interface with any potentially radioactive sources, so radionuclides are not of concern. After evaluating this information, the project team determined that radionuclides are not an issue at MNGP and finds this to be acceptable.

The piping and heating coils of the heating and ventilation (HTV) system use a sulfite-based corrosion inhibitor. The GALL Report recommended EPRI guidelines do not discuss the use of sulfite as an oxygen-de-aerator. Chemical range for the corrosion inhibitor, therefore, is established in accordance with vendor recommendations. Consistent with the GALL Report recommended EPRI TR-107396 and the GALL Report recommended EPRI TR-1008720, pH, corrosion inhibitor concentration, conductivity, and the presence of radionuclides (total gamma activity) levels are periodically monitored. Other chemical parameters are not monitored nor is specific monitoring performed to detect microbiological growth. However, pH is maintained high (11.5 to 12) to minimize the potential for microbiological growth. The system does not interface with refrigerant type coolants, and the makeup water is from a demineralized water source. After evaluating this information, the project team determined that the applicant is accomplishing the ends of the GALL Report by different means and finds this to be acceptable.

The closed cooling loop used on the #14 air compressor, a portion of the instrument and service air (AIR) system, uses an inhibited ethylene glycol solution. The solution contains a minor percentage of diethylene glycol. Consistent with the GALL Report recommended EPRI TR-107396 and the GALL Report recommended EPRI TR-1008720 for blended glycol formulations, a number of key parameters are measured and sampling is performed on a more frequent basis than recommended by the GALL Report recommended EPRI technical reports. All control parameters and diagnostic parameters are monitored, with the exception of the level of corrosion products and of those parameters identified in the GALL Report recommended EPRI technical reports as manufacturer-specific. The level of corrosion inhibitor is monitored, and routine performance monitoring of both coolant levels and heat exchanger performance (system temperatures) are performed, which provide indicators of the possible presence of corrosion products. After evaluating this information, the project team determined that the applicant is accomplishing the ends of the GALL Report by different means and finds this to be acceptable.

The project team concluded that the parameters that the applicant was monitoring, in its closed-cycle cooling water systems, accomplished the same goal as did those that were recommended by the GALL Report. When the applicant was found not to be monitoring a parameter that was recommended by EPRI, it was because that parameter was not used or applicable at MNGP.

On the basis of the above review and a review of MNGP operating experience for the AMP B2.1.13 program (see Section 2.13.5, below), the project team finds this exception to be acceptable.

Exception 3

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| Element: | 3: Parameters Monitored/Inspected |
| Exception: | Some of the heat exchanger and pump performance parameters recommended by NUREG-1801 are not monitored for specific pumps or smaller coolers serviced by the closed-cooling water systems. A number of these components are only in License Renewal scope for pressure boundary considerations. Chemical control and established performance monitoring techniques, based on plant experience, have been adequate to detect changes in system performance due to cracking or corrosion. |

The GALL Report identifies the following recommendation for the “parameters monitored or inspected” program element associated with the exception taken.

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

The project team reviewed selected MNGP inspection and monitoring procedures, then compared the required heat exchanger and pump performance parameters against those recommended by the GALL Report. The project team noted the following exceptions to the GALL Report recommendations and what the applicant was doing in lieu of those recommendations.

The applicant stated that, as an exception to the GALL Report, inlet reactor building closed cooling water (RBC) heat exchanger temperature is not monitored; however, in addition to the recommendations of the GALL Report, the outlet RBC temperature and both inlet and outlet raw water side temperatures are measured. After an evaluation, the project team finds that the additional information that the applicant has gathered is an adequate substitute for that information, recommended by the GALL Report.

The applicant stated that, as an exception to the GALL Report, the residual heat removal (RHR) and reactor recirculation (REC) pump seal coolers pressure is not monitored; however, flow through these pump seal coolers is monitored. MNGP also monitors RBC surge tank level, various temperatures and flows, and radionuclide levels, all of which alarm when values go out of range. These parameters provide indication of pressure integrity failures within this closed loop system. Reduced heat transfer performance, from temperature monitoring results, can also be indicative of internal corrosion. Additionally, the project team noted that the applicant performed ultrasonic test measurements of pipe wall thickness to determine the extent of corrosion on select portions of RBC system piping, including piping connected to the REC system pump seal coolers, inside the drywell, which confirmed the effectiveness of chemistry. However, the project team found no direct inspection to confirm that chemistry is effective in mitigating the effects of corrosion on the RBC system portion connected to the RHR system pump seal coolers or CRD system pump coolers. As an enhancement, the project team observed that a one-time inspection will be performed to monitor the effects of corrosion of the RHR system pump coolers and CRD system pump coolers and nearby connected piping. See Section 2.13.4, below. After an evaluation, the project team finds that the additional information that the applicant has gathered is an adequate substitute for that information, recommended by the GALL Report.

The applicant stated that, as an exception to the GALL Report, the emergency diesel generator (DGN) jacket water pump suction and discharge pressures and flow are not measured; however, water temperature, closed coolant level, lube oil pressure, and lube oil temperature are monitored on a quarterly basis as part of DGN operability tests. As part of the 12-year preventive maintenance requirements for the emergency diesel generators, the jacket water pumps are replaced, the jacket water header of the lube oil cooler is visually inspected, and the jacket water system is inspected for any evidence of leakage from piping or joints (a leak detector dye is used in the coolant). After an evaluation, the project team finds that the additional information that the applicant has gathered is an adequate substitute for that information, recommended by the GALL Report.

The applicant stated that, as an exception to the GALL Report, differential pressure across the DGN coolant heat exchangers is not monitored; however, heat exchanger performance testing is performed on a periodic basis by gathering temperature and flow results. Eddy current testing of the heat exchanger tubes is also performed, periodically. After an evaluation, the project team finds that the additional information that the applicant has gathered is an adequate substitute for that information, recommended by the GALL Report.

The applicant stated that, as an exception to the GALL Report, heating and ventilation (HTV) system and component performance monitoring is not performed. The system contains no heat exchangers, but does contain a number of heating coils to provide heating to various plant locations. The piping system and heater coils are included in the scope of license renewal for pressure integrity only. Some of the heating coils are visually inspected for leaks on a annual basis. After an evaluation, the project team finds that the additional information that the applicant has gathered is an adequate substitute for that information, recommended by the GALL Report.

On the basis of the above review, and of a review of MNGP operating experience for the AMP B2.1.13 program (see Section 2.13.5, below), the project team finds this exception to be acceptable.

Exception 4

Element: 6: Acceptance Criteria
Exception: Some of the acceptance criteria (ranges) for monitored chemistry parameters, based on vendor recommendations and plant operating experience, are not identical to the typical ranges specified by EPRI TR-1008720 or EPRI TR-107396. The ranges established, based on plant operating experience, have been sufficient to manage aging effects.

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

> Corrosion inhibitor concentrations are maintained within the limits specified in the EPRI water chemistry guidelines for CCCW. System and component performance test results are evaluated in accordance with the guidelines of EPRI TR-107396. Acceptance criteria and tolerances are also based on system design parameters and functions.

The project team observed that both EPRI TR-107396 and EPRI TR-1008720 specify normal operating ranges for chemical control parameters. Diagnostic parameters are also specified, but action levels and ranges are not included, as these parameters are used for trending. Specific to the four closed-cycle cooling water systems, the chemical control parameter ranges recommended by EPRI, and hence by the GALL Report, and the corresponding ranges used at MNGP are as follows.

(1) For the chromate-based reactor building closed cooling water (RBC) system, which also serves the reactor heat removal (RHR), reactor recirculation (REC), and control rod drive (CRD) coolers.

- Chromate - Chromate is monitored to a range of 500 to 1800 ppm, not 150 to 300 ppm recommended by the GALL Report recommended EPRI. As noted in the GALL Report recommended EPRI TR-107396 and the GALL Report recommended EPRI TR-1008720, this may have a detrimental impact on pump seal integrity. The RBC pump seals are consumables. The applicant installed a new design seal that is replaced on a two-year frequency. MNGP has monitored but has not detected any impact to system pressure boundary integrity.

- pH - pH is monitored to a more restrictive range of 9.0 to 9.7, versus the GALL Report recommended EPRI TR-107396 range of 8.5 to 10.5 and the GALL Report recommended EPRI TR-1008720 range of 8.0 to 11.0.

- Chloride - Chloride is not monitored in the RBC System. Chloride is monitored in the makeup demineralized water source, which provides makeup to the RBC System. Chloride limits for demineralized water have a limit of 10 ppb, which is substantively lower than the limit of 10 ppm established by the GALL Report recommended EPRI reports.

(2) For the cooling loops of the emergency diesel generators (DGN) system.

- Nitrite - The chemical range for nitrite is identical to the GALL Report recommended EPRI TR-107396 (500 to 1,000 ppm) and more restrictive than the GALL Report recommended EPRI TR-1008720 (50 to 1,500 ppm).
- pH - The range for pH is 9.0 to 10.7, which is more restrictive than the range of 8.5 to 11.0 in the GALL Report recommended EPRI TR-1008720 and close to the range of 8.5 to 10.5 specified in the GALL Report recommended EPRI TR-107396.

- Tolyltriazole - The specified range for tolytriazole is 10 to 40 ppm, as opposed to the 5 to 30 ppm range in the GALL Report recommended EPRI TR-107396, and more restrictive than 5 to 100 ppm range in the GALL Report recommended EPRI TR-1008720. No adverse impacts for slightly higher ranges for tolytriazole were identified in EPRI TR-107396.

- Chloride - Chloride is not monitored in the cooling loops of the DGN System. Chloride is monitored in the makeup demineralized water source, which provides makeup to the cooling loops. Chloride limits for demineralized water have a limit of 10 ppb, which is substantively lower than the limit of 10 ppm established by the GALL Report recommended EPRI reports.

(3) For the piping and heating coils of the heating and ventilation (HTV) System.

- For the piping and heating coils of the HTV System, chemical ranges are not specified by the GALL Report recommended EPRI TR-107396 or by the GALL Report recommended EPRI TR-1008720, so are monitored in accordance with vendor recommendations and plant experience. These include conductivity, pH, phosphate, sulfites, and total gamma activity and are specified by plant procedure.

(4) For the closed cooling loop used on the #14 Air Compressor of the AIR System.

- Glycol % Volume - Both the GALL Report recommended EPRI TR-107396 and the GALL Report recommended EPRI TR-1008720 recommend that glycol percent volume remain above 30 percent to avoid becoming a nutrient for microbiological growth. Further, EPRI TR-1008720 recommends the level remain below 60 percent. The applicant maintains concentration about 50 percent, which is within the range specified by the EPRI reports.

- pH - A specific range for pH is not specified by MNGP procedure. However, procedures do require routine sampling and measurement of pH, and pH is maintained within the range specified by the GALL Report recommended EPRI TR-1008720 of 7.5 to 11.0.

The project team evaluated the operating ranges of each of the above 10 chemical control parameters and noted that 8 were either the equivalent or more conservative than that range recommended by the GALL Report recommended EPRI technical reports. One, the chromate, had a higher range, but MNGP was taking effective action to mitigate the effects of that higher range. The last was in accordance with vendor recommendations and plant operating experience, as the GALL Report provided no recommendation.

On the basis of the above review and a review of MNGP operating experience for the AMP B2.1.13 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 MNGP LRA, that the enhancements in meeting the GALL Report elements as follows:

| | |
|---|---|
| Element: | 3: Parameters Monitored/Inspected |
| Enhancement: | A one-time inspection will be performed to monitor the effects of corrosion on select portions of closed-cycle cooling water systems that perform a pressure integrity intended function. |

The GALL Report identifies the following recommendation for the “parameters monitored or inspected” program element associated with the enhancement.

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

The project team reviewed the applicant’s proposed enhancement and determined that augmenting MNGP closed-cycle cooling water systems with a one-time inspection to monitor the effects of corrosion on select portions of closed-cycle cooling water systems that perform a pressure-integrity intended function will provide additional assurance that aging effects are identified prior to component failures. This is consistent with GALL AMP XI.M21, "Closed-Cycle Cooling Water System." On the basis of its review, 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 Operating Experience

The applicant states in the MNGP LRA that the MNGP Closed-Cycle Cooling Water program has been effective in monitoring and controlling water chemistry, monitoring equipment performance, and in performing its function in mitigating aging effects. Based on a review of condition reports/action requests, the plant has taken timely and effective corrective action when limits were not met to resolve abnormal conditions. Condition reports/action requests are initiated when water chemistry is found to be out of specification or equipment performance does not meet standards. The time duration of these conditions is typically short, and no evidence of detrimental equipment impacts was found. No examples of closed-cycle component cooling water system functional failures due to corrosion, stress corrosion cracking, or heat transfer degradation due to fouling resulting from inadequate chemistry control were identified. There have been steam leaks in various portions of the piping and heating coils of the HTV System (steam traps, temperature control valve packing/gaskets, heating coils, and fittings). These leaks have been isolated and corrected in a timely manner, were typically minor in nature, did not impact the operation of nearby safety equipment, and were not linked to inadequate chemistry or corrosion as the cause of the leak.

The applicant also states in the MNGP LRA that procedural requirements for chemistry limits are established based on EPRI and industry standards and routinely monitored. Recent external and internal assessments have identified chemistry trending as a strength and personnel knowledge as good.

The project team reviewed plant operating experience focusing on areas that indicated the effectiveness of the alternative actions taken by MNGP, due to the exceptions identified above. This review concluded, due to lack of problem indications in the respective areas, that the monitoring and control of cooling water chemistry was effective in minimizing aggressive environments, that pump and heat exchanger performance monitoring was successful in identifying changes due to cracking or corrosion, that the appropriate pumps and heat exchangers were being monitored, and that appropriate acceptance criteria were established based on vendor recommendations, MNGP system design parameters, and operating experience.

The project team review the operating experience provided in MNGP 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 of discussions with the applicant's technical staff, the project team concludes that the applicant's closed-cycle cooling water program, AMP B.2.1.13, will adequately manage the aging effects that are identified in the MNGP LRA, for which this AMP is credited.

2.13.6 USAR Supplement

The applicant provides its USAR Supplement for the Closed-Cycle Cooling Water program in a letter dated June 10, 2005, Enclosure 2, Appendix A, Section A2.1.13, which states that the MNGP Closed-Cycle Cooling Water program includes (1) preventive measures to minimize corrosion and (2) periodic system and component performance testing and inspection to monitor the effects of corrosion and confirm intended functions are met. Preventive measures include the monitoring and control of corrosion inhibitors and other chemical parameters, such as pH, in accordance with the guidelines of Electric Power Research Institute (EPRI) TR-1008720, Closed Cooling Water Chemistry Guideline, vendor recommendations, and plant operating experience. EPRI TR-1008720 is the current revision (Revision 1) of EPRI-107396. As only minor changes were made to the MNGP Closed-Cycle Cooling Water System program to implement EPRI TR-1008720, the program is also still in accordance with the EPRI Revision 0 guidelines identified in NUREG-1801, Chapter XI Program M21 (i.e., EPRI TR-107396, Closed Cooling Water Chemistry Guidelines). Periodic inspection and testing to confirm function and monitor corrosion are also performed in accordance with EPRI TR-1008720, vendor recommendations, and industry and plant operating experience. A review of plant operating experience demonstrates these measures ensure closed-cycle cooling water systems are performing their intended functions.

Section A2.1.13 also states that prior to the period of extended operation, a one time inspection will be performed to monitor the effects of corrosion on select portions of closed-cycle cooling water systems that perform a pressure-integrity intended function.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.13, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR USAR 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 exceptions and the associated justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. Also, the project team has reviewed the enhancement and determined that the implementation of the enhancement prior to the period of extended operation would result in the existing aging management program being consistent with the GALL Report 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 USAR 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 COMPRESSED AIR MONITORING (MNGP AMP B2.1.14)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.14, "Compressed Air Monitoring," is an existing plant program that is consistent with GALL AMP XI.M24, "Compressed Air Monitoring," with exceptions and enhancements.

2.14.1 Program Description

The applicant states in the MNGP LRA that this program consists of inspection, monitoring, and testing of the instrument and service air system to provide reasonable assurance that they will perform their intended function for the duration of extended operation.

The applicant also states in the MNGP LRA that this program is based on NRC Generic Letter 88-14, "Instrument Air Supply System Problems Affecting Safety-Related Equipment;" Institute of Nuclear Power Operators (INPO) Report 88-01, "Instrument Air System Failures;" and Electric Power Research Institute Report TR-103595, "Report of the Instrument Air Working Group," dated April 1994, which were written to assist utilities in identifying and correcting systemic problems in the instrument air system and to enable utilities to maintain required industry safety standards.

2.14.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.14 is an existing program that is consistent with GALL AMP XI.M24, with exceptions and enhancements.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.14, including PBD/AMP-011, "Aging Management Program Basis Document - Compressed Air Monitoring Program," Revision 1, which provides an assessment of how each of the GALL AMP program elements is addressed by MNGP AMP B2.1.14.

The project team also reviewed the program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.14 and the associated bases documents against the GALL AMP XI.M24 for consistency.

The project team reviewed those portions of the Compressed Air Monitoring program for which the applicant claims consistent with GALL AMP XI.M24 and finds that they are consistent the GALL AMP. Furthermore, the project team concludes that the applicant's Compressed Air Monitoring program provides reasonable assurance that the aging effects for which the program is credited will be adequately managed. The project team finds the applicant's Compressed Air Monitoring program acceptable because it conforms to the recommended GALL AMP XI.M24, "Compressed Air Monitoring," with the exceptions and enhancements as described below.

2.14.3 Exceptions to the GALL Report

The applicant states in the MNGP LRA that the exceptions to the GALL Report elements are as follows.

Exception 1

Element: 3: Parameters Monitored or Inspected

Exception: Inservice inspection (ISI) and inservice testing (IST) are not performed to verify proper air quality and confirm that maintenance practices, emergency procedures, and training are adequate to ensure that the intended function of the air system is maintained. This is not an ISI or IST function or activity at MNGP. Air quality is verified by semiannual testing performed by staff engineering personnel. The air quality testing is accomplished by procedure based on GL 88-14, ANSI/ISA S7.3, ANSI Z86.1-1973, and EPRI TR-103595. Maintenance practices, emergency procedures, and training are controlled via station administrative and training procedures.

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

> Inservice inspection (ISI) and testing is performed to verify proper air quality and confirm that maintenance practices, emergency procedures, and training are adequate to ensure that the intended function of the air system is maintained.

The project team reviewed the applicant's Compressed Air Monitoring program and the applicant's ISI program, and then determined that the compressed air system components were outside the scope of the ISI program. To perform ISI on the MNGP compressed air monitoring system components would require that the applicant develop appropriate ISI criteria for these systems. Also, the applicant would be required to decide appropriate examination methods and frequencies, and to determine adequate acceptance criteria, sufficient monitoring and trending requirements, and appropriate corrective actions. Therefore, it is difficult to force-fit ISI requirements onto the compressed air monitoring systems, and the applicant decided not to do so. Thus, the project team reviewed the applicant's proposed alternative activities to assess how these managed the effects of aging.

The project team reviewed MNGP procedure 1362, “Air Quality Test for the Instrument Air System,” which is the primary guidance that monitors the level of contaminants and ensures required air quality. The project team finds that this procedure was written incorporating requirements from GL 88-14, “Instrument Air Supply System Problems Affecting Safety-Related Equipment;” ANSI/ISA S7.3, “Quality Standard for Instrument Air;” ANSI/ISA Z86.1-1973, “Commodity Specification for Air and Drager Operating Instruction;” and EPRI TR-103595, “Report of the Instrument Air Working Group.” After an evaluation, the project team determined that the testing requirements of this procedure were consistent with the recommendations of the GALL Report.

The project team reviewed the preventive maintenance program, with related procedures and instructions, and determined that it addressed issues of corrosion and contamination, and helped to ensure the timely detection of degradation of system function. The project team reviewed several MNGP procedures and instructions to learn how they examine for system corrosion and leakage. The project team then found that compressors and dryers are inspected and maintained by preventive maintenance procedures. Compressor operability is verified during weekly and monthly surveillances, which include pressure testing. The project team determined that this was consistent with the recommendations of the GALL Report.

The project team noted that the MNGP compressed air monitoring program uses information from GL 88-14, ANSI/ISA S7.3, ANSI/ISA Z86.1-1973, EPRI TR-103595, and INPO 88-01, augmented by NRC Information Notice (IN) 81-38, “Potentially Significant Equipment Failures resulting from Contamination of Air-Operated Systems” and IN 87-28, “Air System Problems at U.S. Light Water Reactors,” with Supplement 1. The project team found that the MNGP compressed air monitoring program provides detailed recommendations as to how and where to perform inspections and testing that focus on known problem areas in air-operated systems. The project team reviewed several MNGP procedures and instructions and noted that they included the recommended inspections and tests from the above documents. Thus, the project team determined that this was consistent with the recommendations of the GALL Report.

On the basis of its review of these NRC, EPRI, and other industry guidelines and standards, the project team determined that the applicant performs inspection and testing that verifies proper air quality, and confirms that maintenance practices, emergency procedures, and training are adequate to ensure that the intended function of the compressed air monitoring systems are maintained. There are procedures and programs in place at MNGP that perform the activities included in the compressed air monitoring program that are recommended by the GALL Report.

On the basis of a review of the above exception and a review of operating experience for the MNGP AMP B2.1.14 program (see Section 2.14.5, below), the project team finds this exception to be acceptable.

Exception 2

| | |
|---|---|
| Element: | 4: Detection of Aging Effects |
| Exception: | The MNGP program is based on the guidance provided in ANSI/ISA-S7.3-1975, ANSI/ISA-Z86.1-1973, EPRI TR-103595, and Generic Letter 88-14 which is augmented by previous NRC Information Notices (IN) 81-38, IN 87-28, IN 87-28 Supplement 1, and by the Institute of Nuclear Power Operations Significant Operating Experience Report (INPO SOER) 88-01. MNGP takes |

> exception to ANSI/ISA-S7.0.01-1996 because MNGP uses ANSI/ISA-S7.3-1975. MNGP takes exception to ASME OM-S/G-1998, Part 17 as specified in NUREG-1801, XI.M24.

The GALL Report identifies the following recommendation for the “detection of aging effects” program element associated with the exception taken.

> Guidelines in EPRI NP-7079, EPRI TR-108147, and ASME OM-S/G-1998, Part 17, ensure timely detection of degradation of the compressed air system function. Degradation of the piping and any equipment would become evident by observation of excessive corrosion, by the discovery of unacceptable leakage rates, and by failure of the system or any item of equipment to meet specified performance limits.

The project team observed that, in lieu of the EPRI NP-7079 guidelines recommended by the GALL Report to detect degradation of compressed air system function, MNGP developed procedures and instructions based on the following: GL 88-14, “Instrument Air Supply System Problems Affecting Safety-Related Equipment;” ANSI/ISA S7.3, “Quality Standard for Instrument Air;” ANSI/ISA Z86.1-1973, “Commodity Specification for Air and Drager Operating Instruction;” EPRI TR 103595, Report of the Instrument Air Working Group; ” GL 88-14, ANSI/ISA S7.3, ANSI/ISA Z86.1-1973, EPRI TR 103595, and INPO 88-01, augmented by NRC Information Notice (IN) 81-38, “Potentially Significant Equipment Failures resulting from Contamination of Air-Operated Systems;” and IN 87-28, “Air System Problems at U.S. Light Water Reactors,” with Supplement 1. The project team reviewed and compared ANSI/ISA-S7.3-1975 with ANSI/ISA-S7.0.01-1996 and found ANSI/ISA-S7.3-1975 to be acceptable for use at MNGP as it provides more conservative criteria than recommended by ANSI/ISA-S7.0.01-1996.

The project team asked the applicant to clarify why it took exception to ASME OM-S/G-1998, Part 17, which provides guidance concerning the performance testing of instrument air systems in light water reactor power plants. The applicant responded that the scope of components included in the compressed air monitoring activities includes distribution piping, valves, accumulators for air-operated safety-related valves, and the containment isolation valves of the instrument air system. The applicant stated that the instrument air system compressors, receivers, filters, and dryers are not within the scope of license renewal. The applicant also stated that the MNGP compressed air monitoring program provides adequate aging management for those instrument air system components that are included within the scope of license renewal. The project team reviewed several MNGP procedures and instructions to determine their level of adequacy and completeness, their frequencies, and their results, which included a sampling from the MNGP corrective action program, and concluded that the applicant was able to ensure timely detection of degradation of the compressed air system function as evidenced by the ability to detect corrosion or high leak rates, or the failure of any component to meet its performance limits. The project team found the applicant’s response to be acceptable.

On the basis of a review of the above exception and of a review of operating experience for the MNGP AMP B2.1.14 program (see Section 2.14.5, below), the project team finds this exception to be acceptable.

2.14.4 Enhancements

The applicant states in the MNGP LRA that the enhancements in meeting the GALL Report elements are as follows.

Enhancement 1

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|---|---|
| Elements: | 1: Scope of Program |
| Enhancements: | The MNGP Compressed Air Monitoring program procedures will be revised to include corrective action requirements if the acceptance limits for water vapor, oil content, or particulate are not met. Also, the acceptance criteria for oil content testing will be clarified and the basis for the acceptance limits for the water vapor, oil content, and particulate tests will be provided. |

The GALL Report identifies the following recommendation for the "scope of program" program element associated with the enhancement.

> The program manages the effects of corrosion and the presence of unacceptable levels of contaminants on the intended function of the compressed air system. The AMP includes frequent leak testing of valves, piping, and other system components, especially those made of carbon steel, and a preventive maintenance program to check air quality at several locations in the system.

The project team asked the applicant to clarify the above enhancement. The applicant responded that, though it regarded the guidance that was identified in Exception 2 as conservative, in comparison to the guidance that was recommended by the GALL Report, it wanted to apply further conservatism in the event that the acceptance criteria was not met in any area. The acceptance criteria of the MNGP compressed air monitoring systems procedures are evaluated under the MNGP corrective action program. The project team reviewed the enhancement and determined that this potential augmentation of the acceptance criteria of MNGP compressed air monitoring systems procedures is consistent with the recommendations of the GALL Report and will provide additional assurance that aging effects are identified prior to compressed air monitoring component failure. Therefore, the project team finds that this enhancement is acceptable.

On the basis of a review of the above enhancement and a review of operating experience for the MNGP AMP B2.1.14 program (see Section 2.14.5, below), the project team finds this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 2

| | |
|---|---|
| Elements: | 4: Detection of Aging Effects |
| Enhancements: | The MNGP Compressed Air Monitoring program will be revised to include inspection of air distribution piping based on the recommendations of EPRI TR-108147. |

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

> Guidelines in EPRI NP-7079, EPRI TR-108147, and ASME OM-S/G-1998, Part 17, ensure timely detection of degradation of the compressed air system function. Degradation of the piping and any equipment would become evident by observation of excessive corrosion, by the discovery of unacceptable leakage rates, and by failure of the system or any item of equipment to meet specified performance limits.

The project team asked the applicant to clarify the above enhancement. The applicant responded that the subject piping was addressed by EPRI TR-108147, which included updated recommendations. The project team reviewed the enhancement and determined that expanding the detection of aging effects to this additional air distribution piping was consistent with the recommendations of the GALL Report, and will provide additional assurance that aging effects are identified prior to compressed air monitoring component failure.

On the basis of a review of the above enhancement and of a review of the operating experience for the MNGP AMP B2.1.14 program (see Section 2.14.5, below), 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.

2.14.5 <u>Operating Experience</u>

The applicant states in the MNGP LRA that the compressed air monitoring program has been effective in monitoring instrument and service air system performance and, as enhanced, will effectively manage aging effects due to corrosion. The program is based on appropriate NRC requirements and industry guidance, including MNGP's response to NRC GL 88-14. Established preventive maintenance tasks and other inspections are performed on a routine basis. For example, a major preventive maintenance task was performed and completed in June 2003. A number of system leaks were identified, the system engineer was notified, and repair work orders were initiated and completed to repair the leaks. Preventive maintenance and inspections, system repairs, ongoing monitoring, and review of plant and industry operating experience have been effective in maintaining air system performance.

The project team reviewed the operating experience provided in the MNGP 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 on discussions with the applicant's technical staff, the project team concludes that the compressed air monitoring program will adequately manage the aging effects that have been identified in the MNGP LRA for which this AMP is credited.

2.14.6 <u>USAR Supplement</u>

The applicant provides its USAR Supplement for the compressed air monitoring program in a letter dated June 10, 2005, Enclosure 2, Appendix A, Section A2.1.14, which states that the MNGP program consists of inspection, monitoring, and testing of the instrument and service air systems to provide reasonable assurance that they will perform their intended function for the period of extended operation.

Section A2.1.14 also states that prior to the period of extended operation, (1) the Compressed Air Monitoring Program procedures will be revised to include corrective action requirements if the acceptance limits for water vapor, oil content, or particulate are not met. Also, the acceptance criteria for oil content testing will be clarified and the basis for the acceptance limits for the water vapor, oil content, and particulate tests will be provided; and (2) the Compressed Air Monitoring Program will be revised to include inspection of air distribution piping based on the recommendations of EPRI TR-108147.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.14, 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 USAR Supplement table and as required by 10 CFR 54.21(d).

2.14.7 Conclusion

On the basis of its review and audit of the applicant's program, the project team finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the project team has reviewed the exceptions and the associated justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. Also, the project team has reviewed the enhancements and determined that the implementation of the enhancements prior to the period of extended operation would result in the existing aging management program being consistent with the GALL Report 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 USAR 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 ELECTRICAL CABLES AND CONNECTIONS NOT SUBJECT TO 10 CFR 50.49 ENVIRONMENTAL QUALIFICATION REQUIREMENTS (MNGP AMP B2.1.15)

In MNGP LRA, Appendix B, Section B2.1.15, the applicant states that MNGP AMP B2.1.15, "Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program," is a new plant program that will be consistent with GALL AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

2.15.1 Program Description

The applicant states in the MNGP LRA that this program will manage the aging of conductor insulation material on cables, connectors, and other electrical insulation materials that are in an adverse localized environment caused by heat, radiation, or moisture. The scope of this program will include accessible non-EQ electrical cables and connections, including control and instrumentation circuits, within the scope of license renewal.

The applicant also states that this program will consider the technical information and guidance provided in NUREG/CR-5643, IEEE Std. P1205-2000, SAND96-0344, "Aging Management Guideline for Commercial Nuclear Power Plants - Electrical Cable and Termination," and EPRI TR-109619, Guideline for the Management of Adverse Localized Equipment Environments."

This program will be a sampling program in which selected cables and connections from accessible areas will be inspected and represent, with reasonable assurance, all cables and connections in the adverse localized environments.

2.15.2 Consistency with the GALL Report

In LRA Section B2.1.15, the applicant states that AMP B2.1.15 is consistent with the GALL AMP XI.E1.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.15, including PBD/AMP-030, Revision 1, “Aging Management Program Basis Document - Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.E1.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in MNGP AMP B2.1.15 and associated bases documents against the GALL AMP XI.E1 for consistency.

During the audit and review, the project team asked the applicant to clarify the technical basis for selecting the sample of cables located in an adverse localized environment described in PBD/AMP-030. PBD/AMP-030 indicates that the sample of cables is selected based on the severity of adverse localized environment as compared to the plant design environment and other criteria such as accessibility, availability, importance to safety, or prior inspections results. The applicant in response states the following:

> The Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program has not been written. The technical basis will be provided in the site program document. This program will consider the guidance provided by Contractor Report SAND96-0344 Aging Management Guideline for Commercial Nuclear Power Plants - Electrical Cable and Terminations, Section 6.3.3. This guidance provides for consideration of location (proximity to high-temperature equipment and radiation sources), environment (design vs actual), ampacity (rated vs design currents), and other criteria. The program will consider site operating experience and trend data, cables in systems important to safety and necessary for reliable operation, and cables in locations not normally accessible during normal plant operation, to ensure that a representative sample is evaluated.

The project team reviewed the applicant’s response and determined that it is acceptable.

The project team reviewed those portions of the MNGP AMP B2.1.15, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program," which the applicant claims will be consistent with GALL AMP XI.E1, “Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements,” and finds that they will be consistent with the GALL AMP XI.E1. Furthermore, the project team concludes that the applicant’s AMP will provide reasonable assurance that the program will adequately manage plant aging.

The project team finds the applicant’s Electrical Cables and Connections Not Subject to 10 CFR

50.49 Environmental Qualification Requirements program acceptable because it will conform to the recommended GALL AMP XI.E1, “Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.”

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

None

2.15.4 <u>Enhancements</u>

None

2.15.5 <u>Operating Experience</u>

The applicant states in the MNGP LRA that the electrical cables and connections not subject to 10 CFR 50.49 environmental qualification requirements program are a new program with no operating experience history. However, as noted in the GALL Report, industry operating experience has shown that adverse localized environments caused by heat or radiation for electrical cables and connections have been shown to exist and have been found to produce degradation of insulating materials that is visually observable.

During the audit and review, the project team asked the applicant how operating experience is captured. The applicant indicated that the site’s Corrective Action Process (CAP) program identifies, tracks, and trends site operating experience related to all site components. Any site component which has been identified as being degraded, as having failed, or as having a potential for not being able to fulfill its intended functions is documented in the site CAP data base. These CAPs are then evaluated by plant engineering for extent of condition and appropriate follow-up actions taken. Plant engineering also trends related CAPs to identify generic issues. Trended site issues are addressed in program health reports and presented to site management on a scheduled basis. The CAP also addresses external operating events from INPO, LIS, NMC Fleet, NRC, and Part 21 issues. The project team reviewed the applicant’s response and determined that it is acceptable.

On the basis of its review of the above operating experience and on discussions with the applicant's technical staff, the project team concludes that MNGP AMP B.2.25 will adequately manage the aging effects that have been observed at MNGP.

2.15.6 <u>USAR Supplement</u>

The applicant provides its USAR Supplement for the Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program in the MNGP LRA, Appendix A, Section A2.1.15. The program will address cables and connections whose configuration is such that most cables and connections installed in adverse localized environments are accessible. This program will be a sampling program in which selected cables and connections from accessible areas are inspected and represent, with reasonable assurance, all cables and connections in the adverse localized environments. If an unacceptable condition or situation is identified for a cable or connection in the inspection sample, a determination will be made as to whether the same condition or situation is applicable to other accessible or inaccessible cables or connections.

Subsequently, by letter dated June 10, 2005 (ML051680145), the applicant revised its USAR Supplement to include the following commitment:

> Prior to the period of extended operation, the MNGP Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program will be implemented as a new program consistent with the recommendations of NUREG-1801 Chapter XI Program XI.E1. The program will manage the aging of conductor insulation material on cables, connectors, and other electrical insulation materials that are installed in an adverse localized environment caused by heat, radiation, or moisture.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.15, found that it is consistent with the GALL Report, and determined that it will provide an adequate summary description of the program, as identified in the SRP-LR FSAR Supplement table, 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 will be 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 consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

## 2.16 ELECTRICAL CABLES NOT SUBJECT TO 10 CFR 50.49 ENVIRONMENTAL QUALIFICATION REQUIREMENTS USED IN INSTRUMENTATION CIRCUITS (MNGP AMP B2.1.16)

In MNGP LRA, Appendix B, Section B2.1.16 , the applicant states that MNGP AMP B2.1.16, “Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits,” is a new program that will be consistent with GALL AMP XI.E2, “Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits," with exceptions.

### 2.16.1 Program Description

The applicant states in the MNGP LRA that this program applies to non-EQ electrical cables used in radiation monitoring and nuclear instrumentation circuits with sensitive, low-level signals that are within scope of license renewal and are installed in adverse localized environments caused by heat, radiation, and moisture in the presence of oxygen.

The applicant also states that this program considers the technical information and guidance provided in NUREG/CR-5643, IEEE Std. P1205-2005, SAND96-0344, “Aging Management Guideline for Commercial Nuclear Power Plants - Electrical Cable and Termination,” and EPRI TR-109619, “Guideline for the Management of Adverse Localized Equipment Environments.” In this aging management program, routine calibration tests will be performed as part of the plant surveillance test program used to identify the potential existence of aging degradation. When an instrumentation loop is found to be out of calibration during routine surveillance testing, troubleshooting will be performed on the loop, including the instrumentation cable.

The applicant further states that in cases where a calibration or surveillance program does not include the cable system in the testing circuit, or, as an alternative to the review of calibration results described above, cable system testing will be performed. A proven cable system test for detecting deterioration of the insulation system (such as insulation resistence test, time domain reflectometry test, or other testing judged to be effective in determining cable insulation conditions) will be performed.

2.16.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.16 is consistent with GALL AMP XI.E2, with exceptions.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.16, including PBD/AMP-031, Revision 1, “Aging Management Program Basis Document - Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements used in Instrumentation Circuits,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.E2.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in MNGP AMP B2.1.16 and associated bases documents against the GALL AMP XI.E2 for consistency.

The project team reviewed those portions of the MNGP AMP B2.1.16, “Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits," which the applicant claims is consistent with GALL AMP XI.E2, “Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits," and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s AMP provides reasonable assurance that the program will adequately manage plant aging. The project team finds MNGP AMP B2.1.16 acceptable because it will conform to the recommended GALL AMP. The project team’s evaluation of the exception is described below.

2.16.3 Exception to the GALL Report

The applicant states in the MNGP LRA that the exceptions to the GALL Report elements are as follows

Elements: 3: Parameters Monitored or Inspected
4: Detection of Aging Effects
5: Acceptance Criteria

Exception: The surveillance test required by the MNGP technical specification either do not include all cables within the scope of license renewal or do not include the cable as part of the calibration procedure. The program will periodically test the cable insulation condition for those cables not already tested by technical specification requirements.

The GALL Report identifies the following criteria for “parameters monitored/inspected,” “detection of aging effects,” and “acceptance criteria” program elements associated with the exception taken:

> Parameters Monitored/Inspected:
>
> The parameters monitored are determined from the plant technical specifications and are specific to the instrumentation loop being calibrated, as documented in the surveillance testing procedure.
>
> Detection of Aging Effects:
>
> Calibration provides sufficient indication of the need for corrective actions by monitoring key parameters and providing trending data based on acceptance criteria related to instrumentation loop performance. The normal calibration frequency specified in the plant technical specifications provides reasonable assurance that severe aging degradation will be detected prior to loss of the cable intended function. The first tests for license renewal are to be completed before the period of extended operation.
>
> Acceptance Criteria:
>
> Calibration readings are to be within the loop-specific acceptance criteria, as set out in the plant technical specifications surveillance test procedures.

The applicant in the MNGP LRA states for those cables not tested as part of Technical Specification surveillance procedure, the Program will periodically test the cable insulation. The project team reviewed the applicant’s exception and finds that the exception is acceptable since ISG-15 states that either (1) calibration results or findings of surveillance testing or (2) direct testing of cable system can be used to detect electrical cable aging degradation associated with the electrical cables not subject to 10 CFR 50.49 environmental qualification requirements used in instrumentation circuits.

On the basis of its review of the electrical cables not subject to 10 CFR 50.49 environmental qualification requirements used in instrumentation circuits program, in conjunction with the operating experience (see Section 2.16.5, below), the project team finds this exception to be acceptable.

### 2.16.4 Enhancements

None

### 2.16.5 Operating Experience

The applicant states in the MNGP LRA that the Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits program is a new program with no OE history. However, as noted in the GALL Report, industry OE has shown that exposure of electrical cables to adverse localized environments caused by heat or radiation can result in reduced insulation resistance (IR). Reduced IR causes an increase in leakage currents between conductors and from individual conductors to ground. A reduction in IR is a concern for circuits with sensitive, low-level signals such as radiation monitoring and nuclear instrumentation circuits since it may contribute to signal inaccuracies.

During the audit and review, the project team asked the applicant how operating experience is captured. The applicant states that the site's Corrective Action Process (CAP) program identifies, tracks, and trends site operating experience related to all site components. Any site component that has been identified as being degraded, as having failed, or as having a potential for not being able to fulfill its intended functions is documented in the site CAP data base. These CAPs are then evaluated by plant engineering for extent of condition and appropriate follow up actions taken. Plant engineering also trends related CAPs to identify generic issues. Trended site issues are addressed in program health reports and presented to site management on a scheduled basis. The CAP also addresses external operating events from INPO, LIS, NMC Fleet, NRC, and Part 21 issues. The project team reviewed the applicant's response and determined that it is acceptable.

On the basis of its review of the above operating experience and on discussions with the applicant's technical staff, the project team concludes that MNGP AMP B.2.1.16 will adequately manage the aging effects that have been observed at the applicant's plant.

2.16.6 <u>USAR Supplement</u>

The applicant provides its USAR Supplement for the Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits program in the MNGP LRA, Appendix A, Section 1.1.26, which states that the electrical cables not subject to 10 CFR 50.49 environmental qualification requirements used in instrumentation circuits program are credited for the aging management of radiation monitoring and neutron flux monitoring instrumentation cables not included in the MNGP EQ program. Exposure of electrical cables to adverse localized environments caused by heat or radiation can result in reduced IR. A reduction in IR is a concern for circuits with sensitive, low-level signals such as radiation monitoring and nuclear instrumentation circuits since it may contribute to signal inaccuracies.

The applicant states that in this aging management program, routine calibration tests will be performed as part of the plant surveillance test program used to identify the potential existence of aging degradation. When an instrumentation loop is found to be out of calibration during routine surveillance testing, troubleshooting will be performed on the loop including the instrumentation cable.

The applicant also states that in cases where a calibration or surveillance program does not include the cabling system in the testing circuit, or as an alternative to the review of calibration results described above, NMC will perform cable system testing. A proven cable system test for detecting deterioration of the insulation system (such as insulation resistance tests, time domain reflectometry test, or other testing judged to be effective in determining cable insulation condition) will be performed.

Subsequently, by letter dated June 10, 2005 (ML051680145), the applicant revised its USAR Supplement to include the following commitment:

Prior to the period of extended operation, the Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program will be implemented as a new program. With exceptions, it will be consistent with the recommendations of NUREG-1801 Chapter XI Program XI.E2.

The project team reviewed the USAR Supplement for MNGP AMP B.2.1.16, found that it will be consistent with the GALL Report, and determined that the USAR Supplement provides an adequate summary description of the program, as identified in the SRP-LR USAR Supplement table, as required by 10 CFR 54.21(d).

### 2.16.7 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 will be consistent with the GALL Report. In addition, the project team reviewed the exception to the GALL Report and 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 during the period of extended operation, as required by 10 CFR 54.21(a)(3).

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

## 2.17 FIRE PROTECTION (MNGP AMP B2.1.17)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.17, "Fire Protection," is an existing plant program that is consistent with GALL AMP XI.M26, “Fire Protection,” with exceptions and enhancements.

### 2.17.1 Program Description

The applicant states in the MNGP LRA that this program includes a Fire Barrier Inspection program, a Diesel-Driven Fire Pump Inspection program, and a Halon Fire Suppression System Inspection program. The Fire Barrier Inspection program requires periodic visual inspection of fire barrier penetration seals, fire barrier walls, ceilings, and floors, and periodic visual inspection and functional tests of associated fire-rated doors to ensure that their operability is maintained. The Diesel-Driven Fire Pump Inspection program requires that the pump be periodically tested and the diesel engine inspected to ensure that the fuel supply line can perform the intended function. The Halon Fire Suppression System Inspection included periodic inspection and testing of the cable spreading room halon fire suppression system.

The applicant further states that the Fire Protection program is an existing program. It will be enhanced under parameters monitored or inspected to be consistent, with certain exceptions, with the GALL Report, Chapter XI, Program M26, Fire Protection as modified by ISG-04. The exception to the GALL Report is the periodic visual inspection and function test of halon systems at least once every six months. The Cable Spreading Room Halon System is functionally tested and visually inspected every 18 months instead of every 6 months as recommended in GALL Report AMP, XI.M26.

The Fire Protection System will also be enhanced under detection of aging effects. The existing MNGP Fire Protection program cable spreading room halon visual inspection procedure will be revised to include inspection to detect any signs of degradation such as corrosion and mechanical damage. This visual inspection will provide aging management for external surfaces of the cable spreading room halon fire suppression system. The Fire Protection program plan document will be revised to include qualification criteria for individuals performing visual inspections of penetration seals, fire barriers, and fire doors. The qualification criteria will be in accordance with VT-1 or equivalent and VT-3 or equivalent, as applicable.

As stated in the MNGP USAR Section 10.3.1.1, the Fire Protection program has been established to minimize the likelihood of fires, ensure the capability to shut down the reactor and maintain it in a safe shutdown condition, and minimize radioactive releases to the environment in the event of a fire. The Fire Protection program implements the philosophy of defense-in-depth protection against the hazards of fire and its associated effects on equipment important to safety by preventing fires from starting, detecting, and extinguishing fire that do occur and to provide protection for structures, systems, and components important to safety so that a fire not promptly extinguished by fire suppression activities will not prevent safe shutdown of the plant.

### 2.17.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.17 is consistent with GALL AMP XI.M26, with exceptions and enhancements.

In interviewing the applicant's technical staff and in reviewing, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.17, including PBD/AMP-013, "Aging Management Program Basis Document - License Renewal Aging Management Program Description of the Fire Protection Program," which provides an assessment of the AMP elements, the project team concludes that the applicant is consistent with the GALL Report AMP XI.M26.

The project team also performed reviews of the seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.17 and associated bases documents against the GALL Report AMP XI.M26 for consistency.

The project team reviewed those portions of the applicant’s Fire Protection program for which the applicant claims consistent with GALL Report AMP XI.M26 and finds that they are consistent the GALL Report AMP. Furthermore, the project team concludes that the applicant’s Fire Protection program provides reasonable assurance that components of the Fire Protection system will be managed for aging effects during the period of extended operation. The project team reviewed the applicant’s response, evaluated plant procedures, and finds the applicant’s Fire Protection program acceptable because it conforms to the recommended GALL Report AMP XI.M26, "Fire Protection," with the exceptions and enhancements as described below.

### 2.17.3 Exceptions to the GALL Report

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

Element: 3: Parameters Monitored or Inspected
Exception: Periodic visual inspection and function test of halon systems at least once every 6 months. The Cable Spreading Room Halon System is functionally tested and visually inspected every 18 months instead of every 6 months as recommended in GALL AMP, XI.M26.

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

> Periodic visual inspection and function test at least once every six months examines the signs of degradation of the halon/carbon dioxide fire suppression system. The suppression agent charge pressure is monitored in the test. Material conditions that may affect the performance of the system, such as corrosion, mechanical damage, or damage to dampers, are observed during these tests. Inspections performed at least once every month to verify that the extinguishing agent supply valves are open and the system is in automatic mode.

The applicant states, in the MNGP LRA,Section B2.1.17 and PDB/AMP-013, Fire Protection program, Section 2.3, Rev. 1 that the justification for the Cable Spreading Room Halon System being functionally tested and visually inspected every 18 months instead of every 6 months as recommended in the GALL Report AMP, XI.M26 is that the surveillance interval specified in the Operations Manual is part of the NRC-approved Fire Protection program, thus forming an element of the plant's CLB. In response to the project team interviews, MNGP personnel provided further information including the MNGP – System Health Report – Fire Protection.

MNGP technical staff states that they review industry operating experience, perform surveillance test results for this test and have plant-specific operating experience for this subsystem. This review of operating experience has revealed no age-related degradation and thus the applicant states that the 18-month frequency is acceptable.

The project team interviewed the applicant for parameters monitored/inspected as part of Fire Protection relative to the guidelines for frequency of inspections. The applicant states that the program does have specific guidelines as to the frequency of inspections. For example, penetration seals require visual inspections of fire area boundaries protecting safe shutdown equipment every 18 months or following repair or maintenance of such penetrations. These inspections represent 10% of each type of seal, which is consistent with GALL Report recommendations. The project team also reviewed other inspection criteria related to fire doors, the diesel driven fire pump, and the halon/carbon dioxide systems. The project team finds in its evaluation that based on the review of industry and plant specific operating experience, performance of MNGP surveillance tests and Fire Protection System Health Reports that the exception of the inspection frequency of 18 months instead of 6 months is acceptable. This is based on the fact that there were no differences in finding aging effects using a 6-month or 18-month frequency. Because the incubation period is long for the effect, the 18-month frequency is acceptable and consistent with the GALL Report for managing aging.

2.17.4 Enhancements

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

| | |
|---|---|
| Element: | 4: Detection of Aging Effects |
| Enhancement: | The existing MNGP Fire Protection program cable spreading room halon visual inspection procedure will be revised to include inspection to detect any signs of degradation, such as corrosion and mechanical damage. This visual inspection will provide aging management for external surfaces of the cable spreading room halon fire suppression system. The fire protection program plan document will be revised to include qualification criteria for individuals performing visual inspections of penetration seals, fire barriers, and fire doors. The qualification criteria will be in accordance with VT-1 or equivalent and VT-3 or equivalent as applicable. |

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

> 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. 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.

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The project team interviewed the MNGP technical staff about the guidelines related to the frequency of visual inspections. In response, the applicant technical staff states that this program will have guidelines as to the percentage and frequency of visual inspections to manage aging during the period of extended operation. The details of this enhanced program are located in PBD/AMP-013, (Sec. 3.3) Fire Protection, Rev.1. In this program, the Halon/Carbon Dioxide Systems Cable Spreading Room Operations Manual, “Fire Protection System Operation-Surveillance Requirements,” requires visual examination of the entire system headers/nozzles and the performance of airflow tests upon any evidence of obstructions of any nozzle at 18 month intervals (as noted in the exception above). An airflow test through the headers and nozzles is performed every three years to assure no blockage.

In addition, the project team interviewed MNGP technical staff on other requirements related to qualification criteria as called out by GALL Report. The applicant’s technical staff responds as noted; the qualification criteria for individuals to perform the visual inspections are supported by existing Qualification Criteria assigned to those individuals for the Fire Protection System and the inclusion of qualified personnel to look at these locations with the enhanced procedure. Review of the qualification procedures by the project team found that these procedures will assure adequate training of individuals performing inspections of the Fire Protection System.

The project team finds in its evaluation and review of plant-specific operating experience that the enhancement to the Fire Protection Program to detect signs of aging by including Qualification Criteria for inspection personnel and to inspect the penetration seals, fire barriers, and fire doors by performing VT-1 and VT-3 inspections is an acceptable enhancement and consistent with the GALL Report for this AMP, which would manage aging during the period of extended operation.

On the basis of the project team evaluation of the above enhancement and review of the operating experience for the MNGP AMP B2.1.17 program (see Section 2.17.5, below), 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.

2.17.5 Operating Experience

The applicant states in the MNGP LRA that the Fire Protection program has been effective in managing the aging effects of fire protection features and barriers. Through the use of established plant surveillances and procedures, barriers and other features are inspected on a periodic basis. Recent assessments have noted the overall material condition as good. For example, the December 2000 self-assessment utilizing industry guidance (Nuclear Energy Institute Self-Assessment Guide 99-05) concluded the observed seals and fireproofing appeared in good condition. Problems are documented and resolved through the site Corrective Action program. Prior issues noted with program performance during the NRC 2002 inspection were entered into the site Correction Action program for assessment and resolution. MNGP implemented a number of extensive corrective actions to improve program performance, including improved identification and resolution of deficiencies. An extensive self-assessment was performed in March 2004 to evaluate progress and program compliance. Though some areas of vulnerability were noted for correction and continued focus, a number of program strengths were identified, and the assessment concluded the MNGP program is consistent with corporate directive requirements and made significant progress in addressing 2002 inspection findings.
.
The project team interviewed the applicant as to the effectiveness of the Fire Protection program as being effective in managing aging and that the overall material condition of the system is in good condition. The applicant responds that the operating experience program at MNGP assures that pertinent industry information regarding potential program impacts are disseminated for applicability, evaluations and appropriate action. The operating experience program is evaluated by a corporate fleet procedure implemented by a site-specific procedure. The OE plant specific procedure screens NRC information notices, generic letters, and other industry experience. A self-assessment of fire protection was performed in December 2000. The conclusion of this assessment found that the condition of seals and other fire protection related equipment was in good condition, which meant that there was not material degradation and that it was in such a condition as to perform its intended function. Based on the information provided and review of operating experience references, the project team concluded that the Fire Protection program would provide adequate aging management during the period of extended operation.

The project team reviewed the operating experience provided in MNGP 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 operating experience and discussions with the applicant's technical staff, the project team concludes that the applicant’s AMP B.2.1.17 will adequately manage the aging effects that are identified in MNGP LRA for which this AMP is credited.

2.17.6 USAR Supplement

The applicant provides its USAR Supplement for the Fire Protection program in a letter dated June 10, 2005, Enclosure 2, Appendix A, Section A2.1.17, which states that the MNGP program for license renewal purposes the MNGP Fire Protection program includes a Fire Barrier Inspection program, a Diesel-Driven Fire Pump Inspection program, and a Halon Fire Suppression System Inspection.

The Fire Barrier Inspection program requires periodic visual inspection of fire barrier penetration seals, fire barrier walls, ceilings, and floors, and periodic visual inspection and functional tests of associated fire rated doors to ensure that their operability is maintained.

The Diesel-Driven Fire Pump Inspection program requires that the pump be periodically tested and the diesel engine inspected to ensure that the fuel supply line can perform the intended function. The Halon Fire Suppression System inspection included periodic inspection and testing of the cable spreading room Halon Fire Suppression System.

Section A2.1.17 also states that prior to the period of extended operation:
1) The MNGP Fire Protection Program will be revised to include a visual inspection of the halon fire suppression system to detect any signs of degradation, such as corrosion and mechanical damage. This visual inspection will provide aging management for external surfaces of the halon fire suppression system; and
2) The MNGP Fire Protection Program will be revised to include qualification criteria for individuals performing visual inspections of penetration seals, fire barriers, and fire doors. The qualification criteria will be in accordance with VT-1 or equivalent and VT-3 or equivalent, as applicable.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.17, found that it was consistent with the GALL Report and determined that it provided an adequate summary description of the program as identified in the SRP-LR FSAR supplement table and as required by 10 CFR 54.21(d).

2.17.7 Conclusion

On the basis of its audit and review 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 aging management program being consistent with the GALL Report 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 USAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.18 FIRE WATER SYSTEM (MNGP AMP B2.1.18)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.18, "Fire Water System," is an existing plant program that is consistent with GALL AMP XI.M27, “Fire Water System,” with enhancements.

### 2.18.1 Program Description

The applicant states, in the MNGP LRA, the Fire Water System aging management program relies on testing of water based fire protection system piping and components in accordance with applicable National Fire Protection Association (NFPA) recommendations. In addition, this program will be modified to include (1) portions of the fire protection sprinkler system that are subjected to full flow tests prior to the period of extended operation and (2) portions of the fire protection system exposed to water that are internally visually inspected. To ensure that the aging mechanisms of corrosion and biofouling/fouling are properly being managed in the fire water system, periodic full flow flush test and system performance test are conducted. The system is also normally maintained at required operating pressure and is monitored such that loss of system pressure is immediately detected and corrective actions initiated.

The MNGP Fire Water System program is an existing program. It will be enhanced to be consistent with the recommendations of GALL Report AMP XI.M27.

### 2.18.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.18 is consistent with GALL Report AMP XI.M27, with enhancements.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.18, including the PBD/AMP-14, “Aging Management Program Basis Document - Fire Water,” Revision 1, which provides an assessment of the AMP elements' consistency with GALL Report AMP XI.M27.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.18 and associated bases documents against the GALL AMP XI.M27 for consistency.

The project team reviewed those portions of the Fire Water System Program for which the applicant claims to be consistent with GALL Report AMP XI.M27 and finds that MNGP is consistent the with the GALL Report. Furthermore, the project team concludes that the applicant’s Fire Water System program provides reasonable assurance that components of the Fire Water System will be managed for aging effects during the period of extended operation. The project team finds the applicant’s Fire Water System program acceptable because it conforms to the recommended GALL XI.M27, “Fire Water System," with the enhancements as described below.

### 2.18.3 Exceptions to the GALL Report

None

2.18.4 Enhancement

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

| | |
|---|---|
| Element: | 1: Detection of Aging Effects |
| Enhancement: | The MNGP Fire Water System program will be enhanced by implementing procedures that will be revised to include the extrapolation of inspection results to below grade fire water piping with similar conditions that exist within the above grade fire water piping. The MNGP Fire Water System program sprinkler heads will be inspected and tested per NFPA requirements or replaced 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. Enhancements are scheduled for completion prior to the period of extended operation. |

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

> Testing and inspection are conducted for piping, detection and suppression systems, hydrants, and sprinkler systems at regularly scheduled intervals. Both direct and indirect means exist to determine if the Fire Water System is capable of maintaining pressure. Piping inspections are part of proceduralized activities. The objectives of the inspection program are to identify and determine the extent of potential piping degradation and to take preemptive action to maintain operability of fire water piping systems. The environmental and material conditions that exist on the interior of the below grade fire water piping are similar to the conditions that exist above grade.

The applicant states in the MNGP LRA that the enhancement to "detection of aging effects" program elements notes that the program will be revised to include extrapolation of inspection results to below-grade fire water piping with similar conditions that exist within above-grade piping.

The project team interviewed the applicant as to how the program will perform the extrapolation of inspection results (for below-grade fire water piping with similar conditions that exist with above-grade fire water piping) and under what similar conditions this program would be implemented for the fire water piping.

The applicant responds (as noted in PDB/AMP-014, Fire Water, Section 2.4, 3.4, Rev. 1) that wall thickness evaluations of fire protection piping are performed on system components using non-intrusive techniques (e.g., volumetric testing) to identify evidence of loss of material due to aging effects. These inspections will be performed before the end of the current operating term (before the period of extended operation) and then at plant specific intervals during the period of extended operation. Visual inspections will be performed upon each entry. If the environmental and material conditions that exist on the interior surface of the below grade piping are similar to the conditions that exist within the above grade piping, then any aging mechanisms found in above-grade piping will be evaluated for below-grade piping. If aging mechanisms are found for above-grade piping, additional inspection activities will be performed for below-grade piping to ensure the intended functions are maintained.

The project team finds in its evaluation and review of plant-specific operating experience that the enhancement to the Fire Water System to detect signs of aging by performing wall thickness evaluations on above-grade piping, performing inspections before the period of extended operation and extrapolating above-ground conditions to below-ground piping for further inspections is an acceptable enhancement. This enhancement is consistent with the GALL Report recommendations that rely on the NFPA codes and with GALL AMP XI.M27, Fire Water System.

On the basis of its review of above enhancement and review of operating experience for the MNGP AMP B2.1.18 program (see Section 2.18.5, below), 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.

2.18.5 Operating Experience

The applicant states in the MNGP LRA that the Fire Water System program has been effective in managing aging effects due to corrosion and biofouling in the MNGP Fire Water Systems such that the Fire Water System has been able to perform its intended function. Through the use of established plant surveillances and procedures, the system is periodically inspected, tested, flushed, and maintained. The applicant reviews Industry and plant experience to evaluate any potential impacts on MNGP system performance. Performance issues are documented and evaluated in the site corrective action program. System availability has been good as demonstrated by only six cases of system impairment for more than 48 hours since October 1996 to perform required maintenance. System unavailability is within Maintenance Rule program goals.

An example of program activities is the conduct of a Fire Protection System walk down that reported that the system was in good condition and identified two areas of concern. One was greater than minimal packing leakage on the Screenwash/Fire Pump that was trended by the Fire Protection System Engineer. Repacking would be accomplished when necessary. The second concern was with a seal leak on the Fire Protection Jockey Pump. The mechanical seal was replaced under the work control process.

The project team interviewed the applicant' technical staff on operating experience that has been effective in managing aging effects due to biofouling. Biofouling was not mentioned in the scope of program. The project team requested that the applicant make this aging effect consistent. In response, the applicant stated biofouling is addressed in the MNGP Fire Water aging management PDB. A plant procedure provides for the periodic inspection for the presence of zebra mussels with a visual inspection of an area of the plant intake bay. Other procedures annually inspect for biofouling of the intake bay/traveling screen forebays. Another procedure inspects the East and West Service Water Bays at each refueling outage. In addition, biocide treatments, when appropriate, assure measures are in place to preclude biofouling of the Fire Main system. The applicant has included biofouling as an aging management mechanism.  Biofouling has not been a major concern for the operation of MNGP.

The project team reviewed and evaluated the MNGP plant procedures related to biofouling and operating experience related to the Fire Water System.  Based on this review, the project team finds that the procedures will adequately manage biofouling of the Fire Water system.

The project team reviewed the operating experience provided in MNGP 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 operating experience and discussions with the applicant's technical staff, the project team concludes that the applicant's AMP B.2.1.18 will adequately manage the aging effects that are identified in MNGP LRA for which this AMP is credited.

2.18.6  USAR Supplement

The applicant provides its USAR Supplement for the Fire Water System Program in  a letter dated June 10, 2005, Enclosure 2, Appendix A, Section A2.1.18, which states that the MNGP program manages aging by relying on testing of water-based fire protection system piping and components in accordance with applicable NFPA recommendations.  In addition, this program will be modified to include (1) portions of the fire protection sprinkler system that are subjected to full flow tests prior to the period of extended operation and (2) portions of the Fire Protection System exposed to water that are internally visually inspected.  To ensure that the aging mechanisms of corrosion and biofouling/fouling are properly being managed in the fire water system, periodic full flow flush test and system performance test are conducted.  The system is also normally maintained at required operating pressure and is monitored such that loss of system pressure is immediately detected and corrective actions initiated.

Section A2.1.18 also states that prior to the period of extended operation, the Fire Water System Program:
1 ) Implementing procedures will be revised to include the extrapolation of inspection results to below grade fire water piping with similar conditions that exist within the above grade fire water piping, and
2) Sprinkler heads will be inspected and tested per NFPA requirements or replaced before the end of the 50-year sprinkler head service life and at 1 0-year intervals thereafter during the extended period of operation to ensure that signs of degradation, such as corrosion, are detected in a timely manner.

Will verify procedures to be used for aging management activities of the Fire Water System apply testing in accordance with applicable NFPA codes and standards.  Revise the relevant procedures as appropriate.

The project team reviewed the USAR Supplement for MNGP 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 USAR Supplement table and as required by 10 CFR 54.21(d).

2.18.7  Conclusion

On the basis of its review and audit of the applicant's program, the project team finds that those program elements for which the applicant claimed consistency with the GALL 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 aging management program being consistent with the GALL Report 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 USAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.19 FLOW-ACCELERATED CORROSION (MNGP AMP B2.1.19)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.19, "Flow-Accelerated Corrosion," is an existing plant program that is consistent with GALL AMP XI.M17, "Flow-Accelerated Corrosion."

### 2.19.1 Program Description

The applicant states, in the MNGP LRA, that this program manages aging effects (loss of material) due to flow-accelerated corrosion (FAC) on the internal surfaces of carbon or low alloy steel piping, elbows, reducers, expanders, and valve bodies that contain high energy fluids (both single phase and two phase). The program implements the EPRI guidelines in NSAC-202L-R2, "Recommendations for an Effective Flow-Accelerated Corrosion Program." This program also requires the use of CHECWORKS as a predictive tool. Included in the program are (a) an analysis to determine FAC susceptible locations; (b) performance of limited baseline inspections; (c) follow-up inspections to confirm the predictions; and (d) repairing or replacing components, as necessary.

### 2.19.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that AMP B2.1.19 is consistent with the 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 report for MNGP AMP B2.1.19, including PBD/AMP-002, "Aging Management Program Basis Document Flow -Accelerated Corrosion (FAC) Program," Revision 2, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M17.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.19 and associated bases documents against the GALL AMP XI.M17 for consistency.

During the audit and review, the project team asked the applicant to clarify the minimum allowable wall thickness defined in MNGP FAC program. The applicant stated that, if degradation is detected such that the measured wall thickness is less than 87.5% of nominal wall thickness for safety-related piping or 60% of nominal wall thickness for nonsafety-related piping, an engineering evaluation will be performed to determine if the degraded component is acceptable for continued use. If the engineering evaluation determines that a component requires repair or replacement during the inspection outage, a Condition Report (CR)/Action Request (AR) will be initiated in accordance with the site-specific Corrective Action Program. If a planned replacement is required for the next refueling outage, a Work Request (WR) will be initiated in accordance with the site-specific process for Work Requests/Work Orders. In addition to performing engineering evaluation, the applicant will take additional examinations in adjacent areas to bound the thinning and assure that the actual minimum wall is measured.

The applicant conducted a further study to evaluate the adequacy of using 60% of pipe nominal wall as a trigger point for requiring engineering evaluation for non safety-related piping. The applicant determined that, while the 60% acceptance criterion has technical merit from a statistical analysis standpoint, it lacks rigorous justification because no plant-specific analysis has been conducted to ensure its validity for all cases in MNGP. By letter dated August 11, 2005 (ML052280269), the applicant provided its LRA supplement and committed to revise its procedure for the FAC inspection program to use the industry accepted 87.5% of the nominal pipe wall thickness for non safety-related piping as a trigger point for an engineering evaluation.

The project team reviewed those portions of the FAC program for which the applicant claims consistent with GALL AMP XI.M17 and finds that they are consistent with the GALL Report AMP. Each program element in MNGP AMP B2.1.19 and associated program attribute assessment documents was evaluated and compared to the corresponding element in GALL AMP XI.M17. Furthermore, the project team concludes that the applicant’s Flow-Accelerated Corrosion program will manage aging effects so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation. The project team finds the applicant’s FAC program acceptable because it conforms to the recommended GALL XI.M17, “Flow-Accelerated Corrosion."

2.19.3 Exceptions to the GALL Report

None

2.19.4 Enhancements

None

2.19.5 Operating Experience

The applicant states, in the MNGP LRA, that the FAC program has been effective in managing aging effects. Wall thinning problems in single-phase systems have occurred throughout the industry in feedwater and condensate systems, and in two-phase piping in extraction steam lines and moisture separator reheater and feedwater heater drains.

Application of the program at the MNGP has resulted in the identification and replacement of susceptible piping sections with materials more resistant to FAC. For examples, in 1987, the extraction steam lines were found to be degrading due to FAC. As a corrective measure, significant portions of the extraction steam piping were replaced with stainless steel during the 1987 outage. Through discussions with the applicant's technical staff, the project team was informed that, since 1989, at MNGP, there was no replacements have been performed as a result of minimum wall thickness being compromised.

The project team also reviewed: (1) NMC Corporate Directive CD 5.17, Section 3.4, which states that industry operating experience is required to be reviewed via the CHECWORKS Users Group (CHUG); (2) Fleet Procedure FP-PE-FAC-01, Section 3.2.4, "Plant Experience," which requires input from industry operating experience and recommendations from Engineering, Operations, and Maintenance Departments; and (3) an FAC program self-assessment performed in October 2003 (documented in Condition Report 03011014). The project team noted that the applicant incorporated internal and external plant operating experience issues into the plant corrective action program on a continuing basis. The project team concludes that there is reasonable assurance that operating experience will continue to be reviewed in the future to ensure that the effects of aging will be adequately managed.

The project team reviewed the operating experience provided in MNGP 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 operating experience and discussions with the applicant's technical staff, the project team concludes that the applicant's AMP B.2.1.19 will adequately manage the aging effects that are identified in MNGP LRA for which this AMP is credited.

2.19.6 USAR Supplement

The applicant provides its USAR Supplement for the Flow-Accelerated Corrosion program in the MNGP LRA, Appendix A, Section 2.1.19, which states that the MNGP program manages aging effects (loss of material) due to FAC on the internal surfaces of carbon or low alloy steel piping, elbows, reducers, expanders, and valve bodies that contain high energy fluids (both single phase and two phase). The program implements the EPRI guidelines in NSAC-202L-R2. This program also requires the use of CHECWORKS as a predictive tool. Included in the program are (a) an analysis to determine FAC susceptible locations; (b) performance of limited baseline inspections; (c) follow-up inspections to confirm the predictions; and (d) repairing or replacing components, as necessary. The MNGP Flow-Accelerated Corrosion program includes the response made to GL 89-08, Erosion/Corrosion Induced Pipe Wall Thinning.

The project team reviewed the USAR Supplement for MNGP 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).

2.19.7 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. 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 USAR 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).

## 2.20 FUEL OIL CHEMISTRY (MNGP AMP B2.1.20)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.20, "Fuel Oil Chemistry," is an existing plant program that is consistent with GALL AMP XI.M30, "Fuel Oil Chemistry," with exceptions and enhancements.

### 2.20.1 Program Description

The applicant states in the MNGP LRA that this program is an existing program using existing diesel fuel oil system procedures that encompass the NUREG-1801 program recommendations. The Fuel Oil Chemistry program mitigates and manages aging effects on the internal surfaces of diesel fuel oil storage tanks and associated components in systems that contain diesel fuel oil. The program includes (a) surveillance and monitoring procedures for maintaining diesel fuel oil quality by controlling contaminants in accordance with applicable ASTM Standards; (b) periodic draining of water from diesel fuel oil tanks, if water is present; (c) periodic or conditional visual inspection of internal surfaces or wall thickness measurements (e.g., by UT) from external surfaces of diesel fuel oil tanks; and (d) one-time inspections of a representative sample of components in systems that contain diesel fuel oil.

### 2.20.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.20 is consistent with GALL AMP XI.M30, with exceptions and enhancements.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.20, including PBD/AMP-017, "Aging Management Program Basis Document - Fuel Oil Chemistry Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M30.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.20 and associated bases documents against the GALL AMP XI.M30 for consistency.

The project team reviewed those portions of the Fuel Oil Chemistry program for which the applicant claims consistent with GALL AMP XI.M30 and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's Fuel Oil Chemistry program provides reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation. The project team finds the applicant's Fuel Oil Chemistry program acceptable because it conforms to the recommended GALL AMP XI.M30, "Fuel Oil Chemistry," with the exceptions and enhancements as described below.

### 2.20.3 Exceptions to the GALL Report

The applicant states in the MNGP LRA that the exceptions to the GALL Report elements as follows:

Exception 1

Element: 2: Preventive Actions
Exception: The MNGP Fuel Oil Chemistry program does not currently use biocides, stabilizers, and corrosion inhibitors.

The GALL Report identifies the following recommendation for "preventive actions" program element associated with the exception taken:

> The quality of fuel oil is maintained by additions of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel, and corrosion inhibitors to mitigate corrosion. Periodic cleaning of a tank allows removal of sediments, and periodic draining of water collected at the bottom of a tank minimizes the amount of water and the length of contact time. Accordingly, these measures are effective in mitigating corrosion inside diesel fuel oil tanks. Coatings, if used, prevent or mitigate corrosion by protecting the internal surfaces of the tank from contact with water and microbiological organisms.

The applicant states in the MNGP LRA that the MNGP Fuel Oil Chemistry program does not currently use biocides, stabilizers, and corrosion inhibitors. The GALL Report, Section XI.M30, states that the quality of diesel fuel oil is maintained by additions of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel oil, and corrosion inhibitors to mitigate corrosion. MNGP diesel fuel oil is purchased to ASTM D 975 requirements that address stability and corrosion. Biocides, stabilizers, and corrosion-inhibiting additives have not been used at MNGP. Based on operating history and diesel fuel oil management activities, the addition of biocides, biological stabilizers, and corrosion inhibitors into stored diesel fuel oil at MNGP is not necessary. This conclusion is based on inspection activities spanning 20 years indicating no significant corrosion or degradation. Diesel fuel oil quality and particulate contamination is checked. Quarterly checks are performed to ASTM D 975 acceptance criteria.
The project team review finds this exception acceptable based on review of various documents on site, including a comparison of the GALL-recommended ASTMs with those used at MNGP, a review of MNGP historical oil analyses, a review of the program basis document PBD/AMP-017, and discussions with the plant staff. The review of the historical oil analyses and discussions with the plant staff showed that there had been no historical biological breakdown of MNGP fuel oil and that the oil, purchased to ASTM D 975 requirements, has remained stable and corrosion-free in storage and use. On the basis of the above review and its review of plant-specific operating experience for the MNGP AMP B2.1.20 program (see Section 2.20.5, below), the project team finds this exception to be acceptable.

<u>Exception 2</u>

Element: 3: Parameters Monitored/Inspected
Exception: ASTM D 2709 and ASTM D 2276 are not utilized at the MNGP.

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

> The AMP monitors fuel oil quality and the levels of water and microbiological organisms in the fuel oil, which cause the loss of material of the tank internal surfaces. The ASTM Standard D 4057 is used for guidance on oil sampling. The ASTM Standards D 1796 and D 2709 are used for determination of water

> and sediment contamination in diesel fuel. For determination of particulates, *modified* ASTM D 2276, Method A, is used. The modification consists of using a filter with a pore size of 3.0 :m, instead of 0.8 :m. These are the principal parameters relevant to tank structural integrity.

The applicant states, in the MNGP LRA, that: ASTM D 2709 and ASTM D 2276 are not utilized at the MNGP. The GALL Report, Section XI.M30, recommends the use of ASTM Standards D 1796 and D 2709 to test for water and sediment in diesel fuel oils. MNGP uses only ASTM D 1796 for verification that water and sediment are within specified limits. This standard is applicable to the grade of diesel fuel oil used at MNGP. The GALL Report, Section XI.M30, also recommends the use of a modified ASTM D 2276 for sampling of particulate contaminants. MNGP uses ASTM Standard D 6217 as a laboratory test to sample diesel fuel oil for suspended particulates. This standard is applicable to the grade of diesel fuel oil used at MNGP. ASTM Standard D 6217 also utilizes the more conservative filter pore size of 0.8 :m versus the recommended 3.0 :m.

The project team review finds this exception acceptable based on review of various documents on site, including a comparison of the GALL-recommended ASTMs with those used at MNGP. A review of ASTM D 6217 shows that this laboratory analysis of the fuel oil is specifically applicable to the grade of oil used at MNGP, and it uses a more conservative filter pore size than that recommended by the GALL Report. On the basis of the above review and its review of plant-specific operating experience for the MNGP AMP B2.1.20 program (see Section 2.20.5, below), the project team finds this exception to be acceptable.

<u>Exception 3</u>

> Element: 6: Acceptance Criteria
> Exception: ASTM D 2709 and ASTM D 2276 are not utilized at MNGP.

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

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

The applicant states, in the MNGP LRA, that ASTM D 2709 and ASTM D 2276 are not utilized at MNGP. The GALL Report, Section XI.M30, recommends the use of ASTM Standards D 1796 and D 2709 to test for water and sediment in diesel fuel oils. MNGP uses only ASTM D 1796 for verification that water and sediment are within specified limits. This standard is applicable to the grade of diesel fuel oil used at MNGP. GALL Report, Section XI.M30, also recommends the use of a modified ASTM D 2276 for sampling of particulate contaminants. MNGP uses ASTM Standard D 6217 as a laboratory test to sample diesel fuel oil for suspended particulate. This standard is applicable to the grade of diesel fuel oil used at MNGP. This standard utilizes the more conservative filter pore size of 0.8 :m versus the recommended 3.0 :m.

The project team review determined that this exception is acceptable, based on review of various documents on site, including a comparison of the GALL-recommended ASTMs with those used at MNGP. A review of ASTM D 1796 reveals that this ASTM is specifically applicable to the type of diesel fuel used at MNGP and contains the necessary and sufficient requirements for sampling for sediment and water. Additionally, a review of ASTM D 6217 shows that it contains test parameters, performed by an offsite laboratory, equivalent to the GALL- recommended ASTM D 2276. On the basis of the above review and its review of plant-specific operating experience for the MNGP AMP B2.1.20 program (see Section 2.20.5, below), the project team finds this exception to be acceptable.

2.20.4 Enhancements

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

Enhancement 1

| | |
|---|---|
| Element: | 1: Scope of Program |
| Enhancement: | The MNGP procedures related to the Diesel Fuel Oil System will be revised to include requirements to check for general, pitting, crevice, galvanic, microbiological influenced corrosion (MIC), and cracking. |

The GALL Report identifies the following recommendation for the “scope of program” program element associated with the enhancement:

> The program is focused on managing the conditions that cause general, pitting, and microbiologically influenced corrosion (MIC) of the diesel fuel tank internal surfaces. The program serves to reduce the potential of exposure of the tank internal surface to fuel oil contaminated with water and microbiological organisms.

The applicant states, in the MNGP LRA, that the MNGP procedures related to the Diesel Fuel Oil System will be revised to include requirements to check for general, pitting, crevice, galvanic, microbiological influenced corrosion (MIC), and cracking.

The project team review of various documents on site (including a comparison of the GALL-recommended ASTMs with those used at MNGP, the program basis document PBD/AMP-017, and discussions with the plant staff) determined that these requirements to check for general, pitting, crevice, galvanic, microbiological-influenced corrosion (MIC), and cracking would provide a continuing check on the effectiveness of the program. On the basis of the above review and its review of plant-specific operating experience for the MNGP AMP B2.1.20 program (see Section 2.20.5, below), the project team finds this enhancement to be acceptable as such changes to the applicant’s program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 2

| | |
|---|---|
| Element: | 2: Preventive Actions |
| Enhancement: | Revise MNGP Fuel Oil Chemistry program procedures to require tank draining, cleaning, and inspection if deemed necessary based on the trends indicated by the results of the diesel fuel oil analysis, or as recommended by the system engineer based on equipment operating experience. |

The GALL Report identifies the following recommendation for the “preventive actions” program element associated with the enhancement:

> The quality of fuel oil is maintained by additions of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel, and corrosion inhibitors to mitigate corrosion. Periodic cleaning of a tank allows removal of sediments, and periodic draining of water collected at the bottom of a tank minimizes the amount of water and the length of contact time. Accordingly, these measures are effective in mitigating corrosion inside diesel fuel oil tanks. Coatings, if used, prevent or mitigate corrosion by protecting the internal surfaces of the tank from contact with water and microbiological organisms.

The applicant states, in the MNGP LRA, that MNGP Fuel Oil Chemistry program procedures will be revised to require tank draining, cleaning, and inspection if deemed necessary based on the trends indicated by the results of the diesel fuel oil analysis or as recommended by the system engineer based on equipment operating experience.

The project team review of various documents on site (including a comparison of the GALL-recommended ASTMs with those used at MNGP, the program basis document PBD/AMP-017, and discussions with the plant staff) determined that these requirements of providing tank draining, cleaning, and inspection if deemed necessary based on the trends indicated by the results of the diesel fuel oil analysis, or as recommended by the system engineer based on equipment operating experience, would provide a continuing check on the effectiveness of the program. On the basis of the above review and its review of plant-specific operating experience for the MNGP AMP B2.1.20 program (see Section 2.20.5, below), the project team finds this enhancement to be acceptable as such changes to the applicant’s program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 3

| | |
|---|---|
| Element: | 4: Detection of Aging Effects |
| Enhancement: | Write procedure or revise existing procedures in the MNGP Fuel Oil Chemistry program to require periodic tank inspections of the diesel fuel oil tanks. |

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

> Degradation of the diesel fuel oil tank cannot occur without exposure of the tank internal surfaces to contaminants in the fuel oil, such as water and microbiological organisms. Compliance with diesel fuel oil standards in item 3, above, and periodic multilevel sampling provide assurance that fuel oil contaminants are below acceptable levels. Internal surfaces of tanks that are drained for cleaning are visually inspected to detect potential degradation. However, corrosion may occur at locations in which contaminants may accumulate, such as a tank bottom, and an ultrasonic thickness measurement of the tank bottom surface ensures that significant degradation is not occurring.

The applicant states, in the MNGP LRA, that, procedures will be written or existing procedures will be revised in the MNGP Fuel Oil Chemistry program to require periodic tank inspections of the diesel fuel oil tanks. The project team review of various documents on site (including a comparison of the GALL-recommended ASTMs with those used at MNGP, the program basis document, PBD/AMP-017, and discussions with the plant staff) determined that these requirements that procedures will be written or existing procedures will be revised in the MNGP Fuel Oil Chemistry program to require periodic tank inspections of the diesel fuel oil tanks, provide a continuing check on the effectiveness of the program. The addition of periodic tank inspections will bring the program into congruence with the recommendations of the GALL Report. On the basis of the above review and its review of plant-specific operating experience for the MNGP AMP B2.1.20 program (see Section 2.20.5, below), 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.

2.20.5 <u>Operating Experience</u>

The applicant states in the MNGP LRA that the MNGP Fuel Oil Chemistry program provides reasonable assurance that the aging effect of loss of material caused by various corrosion mechanisms and cracking will be adequately managed. The diesel fuel oil system components that are covered by this program will continue to perform their intended functions for the period of extended operation. The diesel fuel oil monthly and quarterly sampling and trending have confirmed the adequacy of the diesel fuel oil supply. Past tank cleanings and inspections have shown that the condition of the tanks has not degraded.

The project team reviewed the operating experience provided in the MNGP 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 on discussions with the applicant's technical staff, the project team concludes that MNGP AMP B.2.1.20 adequately manages the aging effects that are identified in the MNGP LRA for which this AMP is credited.

2.20.6 <u>USAR Supplement</u>

The applicant provides its USAR Supplement for the Fuel Oil Chemistry program in a letter dated June 10, 2005, Enclosure 2, Appendix A, Section A2.1.20, which states that the MNGP program is an existing program using existing diesel fuel oil system procedures that encompass the NUREG-1801 program recommendations. The Fuel Oil Chemistry program mitigates and manages aging effects on the internal surfaces of diesel fuel oil storage tanks and associated components in systems that contain diesel fuel oil. The program includes (a) surveillance and monitoring procedures for maintaining diesel fuel oil quality by controlling contaminants in accordance with applicable ASTM Standards; (b) periodic draining of water from diesel fuel oil tanks, if water is present; (c) periodic or conditional visual inspection of internal surfaces or wall thickness measurements (e.g., by UT) from external surfaces of diesel fuel oil tanks; and (d) one-time inspections of a representative sample of components in systems that contain diesel fuel oil.

Section A2.1.20 also states that prior to the period of extended operation:
1 ) The MNGP procedures related to the Diesel Fuel Oil System will be revised to include requirements to check for general, pitting, crevice, galvanic, microbiologicalyl influenced corrosion (MIC), and cracking.
2) The MNGP Fuel Oil Chemistry Program procedures will be revised to require tank draining, cleaning, and inspection if deemed necessary based on the trends indicated by the results of the diesel fuel oil analysis, or as recommended by the system engineer based on equipment operating experience.

Develop or revise existing procedures in the MNGP Fuel Oil Chemistry Program to require periodic tank inspections of the diesel fuel oil tanks.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.20, found that it was consistent with the GALL Report and determined that it provides an adequate summary description of the program, as identified in the SRP-LR FSAR supplement table and as required by 10 CFR 54.21(d).

2.20.7 Conclusion

On the basis of its audit and review of the applicant's program, the project team finds that those 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 exceptions and the associated justifications and determined that the AMP, with the exceptions is adequate to manage the aging effects for which it is credited. Also, the project team has reviewed the enhancement(s) and determined that the implementation of the enhancements prior to the period of extended operation would result in the existing aging management program being consistent with the GALL Report 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 USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.21 INACCESSIBLE MEDIUM-VOLTAGE CABLES NOT SUBJECT TO 10 CFR 50.49 ENVIRONMENTAL QUALIFICATION REQUIREMENTS (MNGP AMP B2.1.21)

In MNGP LRA, Appendix B, Section B2.1.21, the applicant states that MNGP AMP B2.1.21, "Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements," is a new program that will be consistent with GALL AMP XI.E3, "Inaccessible Medium-voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

2.21.1 Program Description

The applicant states in the MNGP LRA that the purpose of this aging management program will be to demonstrate that inaccessible, non-EQ medium-voltage cables susceptible to aging effects caused by moisture and voltage stress will be adequately managed so that there is reasonable assurance that the cables will perform their intended function. When an energized medium-voltage cable is exposed to wet conditions for which it is not designed, water treeing or a decrease in the dielectric strength of the conductor insulation can occur.

The applicant also states that in this aging management program, periodic actions will be taken to prevent cables from being exposed to significant moisture, such as inspecting for water collection in cable manholes and conduit, and draining water, as needed. In-scope, medium-voltage cables exposed to significant moisture and significant voltage are tested to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to the initial test and will be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, polarization index, or other testing that is state-of-the-art at the time the test is performed.

2.21.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.21 will be consistent with the GALL AMP XI.E3.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.21, including PBD/AMP-032, Revision 1, “Aging Management Program Basis Document - Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.E3.

The project team reviewed seven program elements (see Section 1.5.1 of this report) contained in MNGP AMP B2.1.21 and associated bases documents against the GALL AMP XI.E3 for consistency.

During the audit and review, the project team asked the applicant to explain the process for assuring that cables located in conduit are not subject to significant moisture and thus not subject to testing. The applicant indicated that it is impossible to assure that cables located in underground conduit will not be exposed to significant moisture. The applicant further indicated that the majority of their underground cables are directly buried in the ground without the use of conduit and are thus subject to significant moisture and are required to be tested. Cables located in underground conduit are also subject to significant moisture due to condensation and are thus also required to be tested. In addition, under the program element, Parameters Monitored or Inspected, included as part of MNGP AMP B2.1.21, the applicant indicated that the MNGP program will test medium-voltage cables (2kV to 34.5 kV) within the scope of license renewal, which are exposed to moisture (direct buried or in underground conduit) and energized more than 25 percent of the time. The project team reviewed this response and determined that it is acceptable.

The project team reviewed those portions of the MNGP AMP B2.1.21, "Inaccessible Medium-Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements," which the applicant claims will be consistent with GALL AMP XI.E3, “Inaccessible Medium-Voltage Cables

Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," and finds that it will be consistent with the GALL AMP XI.E3. Furthermore, the project team concludes that the applicant's AMP provides reasonable assurance that the program will adequately manage plant aging.

The project team finds the applicant's Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program acceptable because it will conform to the recommended GALL AMP XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

2.21.3 Exceptions to the GALL Report

None

2.21.4 Enhancements

None

2.21.5 Operating Experience

The applicant states in MNGP LRA Appendix B Section B2.1.21 that the inaccessible medium-voltage cables not subject to 10 CFR 50.49 environmental qualification requirements program is a new program and does not have any operating experience. However, as noted in the GALL Report, industry operating experience has shown that XLPE or high-molecular weight polyethylene (HMWPE) insulation materials are most susceptible to water tree formation. The formation and growth of water trees varies directly with operating voltage. Treeing is much less prevalent in 4KV cables than those operated at 13KV or 33KV. Also, minimizing exposure to moisture minimizes the potential for the development of water treeing.

During the audit and review, the project team asked the applicant how operating experience is captured. The applicant indicated that the MNGP Corrective Action Process (CAP) program identifies, tracks, and trends site operating experience related to all site components. Any site component that has been identified as being degraded, as having failed, or as having a potential for not being able to fulfill its intended functions, is documented in the site CAP data base. These CAPs are then evaluated by plant engineering for extent of condition and appropriate follow-up actions taken. Plant engineering also trends related CAPs to identify generic issues. Trended site issues are addressed in program health reports and presented to site management on a scheduled basis. The CAP also addresses external operating events from INPO, LIS, NMC Fleet, NRC, and Part 21 issues. The project team reviewed the applicant's response and determined that it is acceptable.

On the basis of its review of the above operating experience and on discussions with the applicant's technical staff, the project team concludes that MNGP AMP B2.1.21 will adequately manage the aging effects that have been observed at the applicant's plant.

2.21.6 USAR Supplement

The applicant provided its USAR Supplement for the Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program in the LRA Appendix A, Section A2.1.21, which describes the program scope.

The applicant states that in MNGP AMP B2.1.21, periodic actions will be taken to prevent cables from being exposed to significant moisture, such as inspecting for water collection in cable manholes and conduit, and draining water, as needed. In-scope, medium-voltage cables exposed to significant moisture and significant voltage are tested to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to the initial test and will be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, polarization index, or other testing that is state-of-the-art at the time the test is performed.

Subsequently, by letter dated June 10, 2005 (ML051680145), the applicant revised its USAR Supplement to include the following commitment:

> Prior to the period of extended operation, the MNGP Inaccessible Medium-Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program will be implemented as a new program consistent with the recommendations of NUREG-1801 Chapter XI, Program XI.E3.

The project team reviewed the revised LRA USAR Supplement for MNGP AMP B2.1.21, found that it will be consistent with the GALL Report, and determined that it will provide an adequate summary description of the program, as identified in the SRP-LR FSAR supplement table, as required by 10 CFR 54.21(d).

#### 2.21.7 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 will be consistent with the GALL Report. In addition, 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 during the period of extended operation, as required by 10 CFR 54.21(a)(3).

On the basis of its review of the revised USAR 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).

### 2.22 INSPECTION OF OVERHEAD HEAVY LOAD AND LIGHT LOAD (RELATED TO REFUELING) HANDLING SYSTEMS (MNGP AMP B2.1.22)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.22, "Inspection of Overhead Load and Light Load (Related to Refueling) Handling Systems," is an existing plant program that is consistent with GALL AMP XI.M23, “Inspection of Overhead Load and Light Load (Related to Refueling) Handling Systems,” with exceptions and enhancements.

#### 2.22.1 Program Description

The applicant states, in the MNGP LRA, that this program which is implemented through plant procedures and preventive maintenance, manages loss of material of structural components for heavy load and fuel handling components within the scope of license renewal. The Inspection Of Overhead Heavy Load and Light Load (Related To Refueling) Handling Systems program provides for visual and NDE inspections of in-scope load handling components. Functional tests are also performed to assure their integrity. The cranes also comply with the maintenance rule requirements provided in 10 CFR 50.65.

2.22.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.22 is consistent with GALL AMP XI.M23, with an exception and an enhancement.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.22, including PBD/AMP-010 “Aging Management Program Basis Document Inspection - Overhead Heavy Load & Light Load (Related to Refueling) Handling Systems," which provides an assessment of the AMP elements' consistency with GALL AMP XI.M23.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.22 and associated bases documents against the GALL AMP XI.M23 for consistency.

The project team reviewed those portions of the Inspection of Overhead Load and Light Load (Related to Refueling) Handling Systems program for which the applicant claims consistent with GALL AMP XI.M22 and finds that they are consistent the GALL AMP. Furthermore, the project team concludes that the applicant’s Inspection of Overhead Load and Light Load (Related to Refueling) Handling Systems program provides reasonable assurance that the structures, systems, and components of these cranes are capable of sustaining their rated loads and performing their intended function during the period of extended operation. The project team finds the applicant’s Inspection of Overhead Load and Light Load (Related to Refueling) Handling Systems program acceptable because it conforms to the recommended GALL AMP XI.M23, "Inspection of Overhead Load and Light Load (Related to Refueling) Handling Systems," with the exceptions and enhancements as described below.

2.22.3 Exceptions to the GALL Report

The applicant states in the MNGP LRA that the exceptions to the GALL Report elements are as follows:

| | |
|---|---|
| Element: | 3: Parameters Monitored/Inspected |
| Exception: | Except for special lifts made by the Turbine Building crane, the MNGP program does not provide for tracking the number and magnitude of lifts because administrative controls are implemented to ensure that only allowable loads are handled and fatigue failure of structural elements is not expected due to a limited number of lifts. |

The GALL Report identifies the following recommendation for “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 MNGP LRA that except for special lifts made by the Turbine Building crane, the MNGP program does not provide for tracking the number and magnitude of lifts because administrative controls are implemented to ensure that only allowable loads are handled and fatigue failure of structural elements is not expected due to a limited number of lifts. In addition, qualified crane inspectors perform crane inspections and functional checks periodically. Crane operating procedures require crane inspections prior to each use. A time-limited aging analysis concludes that there are no fatigue concerns for the Reactor Building crane during the period of extended operation.

The project team reviewed information on the Reactor Building crane which identifies that the crane has the design capacity for many more lifts at a higher rated tonnage than are expected to take place at MNGP over the 60-year life. Additionally, MNGP provided information to the project team that they also perform inspections and functional checks periodically and prior to use on the other cranes. MNGP also provided Operating Experience which shows no degradation due to aging since plant startup. The project team review determined that this exception is acceptable based on review of MNGP information that demonstrates the design capabilities of the Reactor Building Crane and the required inspections prior to operation of other cranes.

On the basis of the above review and a review of operating experience for the MNGP AMP B2.1.22 program (see Section 2.22.5, below), the project team finds this exception to be acceptable.

2.22.4 Enhancements

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

| | |
|---|---|
| Element: | 4: Detection of Aging Effects |
| Enhancement: | The program will be enhanced to specify a five-year inspection frequency for the fuel preparation machines. |

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

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

The applicant states in the MNGP LRA that crane rails and structural components for heavy load and light load handling equipment within the scope of the program are visually inspected on a routine basis for degradation. Functional tests of the cranes and refueling platform are performed after any preventive maintenance. Functional tests are also performed for the refueling platform prior to any fuel handling operations. Visual inspections of the fuel preparation machines as well as visual and NDE inspections of special lifting devices within the scope of the program are performed on a routine basis. The program will be enhanced to specify a five-year inspection frequency for the fuel preparation machines.

The project team review of various documents on site (including a comparison of the GALL recommendations with the proposed enhancements at MNGP, the program basis document PBD/AMP-010, and discussions with the plant staff) determined that this requirement, a five-year inspection frequency for the fuel preparation machines, provides a continuing check on the effectiveness of the program.  The five-year frequency is acceptable since MNGP operating experience shows no degradation due to aging since installation; therefore, any aging mechanisms are slow-acting.  The addition of a specified periodicity for fuel preparation machine inspection ensures that each component is visually inspected on a routine basis for degradation and conforms with the recommendation of the GALL Report.

On the basis of the above review and a review of operating experience for the MNGP AMP B2.1.22 program (see Section 2.22.5, below), 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.

2.22.5  Operating Experience

The applicant states in the MNGP LRA that no incidents of failure of passive components for cranes and special lifting devices due to aging have occurred at MNGP.  Aging effects in crane and special lifting devices components has been detected and managed by the inspection activities.  A magnetic particle inspection of the Dryer and Steam Separator Sling found a linear indication which was repaired prior to use.  An inspection of the Reactor Vessel Head Lifting Device noted some minor degradation which, in accordance with procedure, was repaired and painted.  These inspections have shown that aging effects are being detected and repaired in a timely manner and providing reasonable assurance that the intended functions of crane and special lifting devices components will be maintained during the period of extended operation.

The project team review the operating experience provided in MNGP 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 on discussions with the applicant's technical staff, the project team concludes that MNGP AMP B.2.1.22 will adequately manage the aging effects that are identified in MNGP LRA for which this AMP is credited.

2.22.6  USAR Supplement

The applicant provides its USAR Supplement for the Inspection of Overhead Load and Light Load (Related to Refueling) Handling Systems program in  a letter dated June 10, 2005, Enclosure 2, Appendix A, Section A2.1.22, which states that the MNGP program, which is implemented through plant procedures and preventive maintenance, manages loss of material of structural components for heavy load and fuel-handling components within the scope of license renewal.  The Inspection of Overhead Heavy Load and Light Load (Related To Refueling) Handling Systems program provides for visual and NDE inspections of in-scope load handling components.  Functional tests are also performed to assure their integrity.  The cranes also comply with the maintenance rule requirements provided in 10 CFR 50.65.

Section A2.1.22 also states that prior to the period of extended operation, the Inspection of Overhead Heavy Load & Light Load (Related to Refueling) Handling Systems Program will be enhanced to specify a five-year inspection frequency for the fuel preparation machines.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.22, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program as identified in the SRP-LR FSAR supplement table and as required by 10 CFR 54.21(d).

2.22.7 Conclusion

On the basis of its audit and review 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 exceptions is adequate to manage the aging effects for which it is credited. Also, the project team has reviewed the enhancement and determined that the implementation of the enhancement prior to the period of extended operation would result in the existing aging management program being consistent with the GALL Report 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 USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.23 ONE-TIME INSPECTION (MNGP AMP B2.1.23)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.23, "One-Time Inspection Program," is a new plant program that is consistent with GALL AMP XI.M32, "One-Time Inspection Program."

2.23.1 Program Description

The applicant states in the MNGP LRA that this program is a new program consistent with the recommendations of GALL AMP XI.M32, "One-Time Inspection." This program will include measures to verify the effectiveness of the Plant Chemistry program and the Fuel Oil Chemistry program. This program will also confirm the absence of age degradation in selected components (e.g., flow restrictors, venturis, and small bore piping) within License Renewal scope. The MNGP One-Time Inspection program addresses concerns and confirmation for the potential long incubation period for certain aging effects on structures and components. There are cases where either (a) an aging effect is not expected to occur but there is insufficient data to completely rule it out or (b) an aging effect is expected to progress very slowly. The activities of the One-Time Inspection program include (a) determination of the sample size based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience; (b) identification of the inspection locations in the system or component based on the aging effect; (c) determination of the examination technique, including acceptance criteria that would be effective in managing the aging effect for which the component is examined; and (d) evaluation of the need for follow-up examinations to monitor the progression of any identified aging degradation.

The applicant states that the program will manage the aging effects due to corrosion, cracking, erosion, fouling, fretting, or thermal exposure. The program will also verify the absence of reduction of neutron absorption capacity of boral in the spent fuel pool.

2.23.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that AMP B2.1.23 is consistent with the GALL AMP XI.M32.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.23, including PBD/AMP-019, “Aging Management Program Basis Document - One-Time Inspection Program,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.M32.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.23 and associated bases documents against the GALL AMP XI.M32 for consistency.

The GALL Report recommendations for the program element “detection of aging effects” include a suggestion that the inspection includes a representative sample of the system population, and, where practical, will focus on the bounding or lead components most susceptible to aging due to time in service, severity of operating conditions, and lowest design margin. For small-bore piping, actual inspection locations are based on physical accessibility, exposure levels, NDE techniques, and locations identified in Nuclear Regulatory Commission (NRC) Information Notice (IN) 97-46. The applicant has noted that the main issue described in IN 97-46 was specific to PWRs. However, similar issues raised concerning BWRs were reviewed as a result of NRC Bulletin 88-08 and found to require no action for MNGP.

The project team reviewed those portions of the One-Time Inspection program for which the applicant claims consistent with GALL AMP XI.M32 and finds that they are consistent the GALL AMP. Furthermore, the project team concludes that the applicant’s One-Time Inspection program provides reasonable assurance that aging effects will be managed so that the systems, structures, and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation. This program will be implemented prior to the period of extended operation. The project team finds the applicant’s One-Time Inspection program acceptable because it conforms to the recommended GALL XI.M32, “One-Time Inspection."

2.23.3 Exceptions to the GALL Report

None

2.23.4 Enhancements

None

2.23.5 Operating Experience

The applicant states in the MNGP LRA that the MNGP One-Time Inspection program is a new program. The MNGP aging management review process ensures that the one-time inspections have been prescribed with consideration of plant and industry operating experience.

The project team recognizes that the corrective action program, which captures the internal and external 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 aging effects are adequately managed.

2.23.6 USAR Supplement

The applicant provides its USAR Supplement for the One-Time Inspection program in the MNGP LRA, Appendix A, Section 2.1.23, which states that the MNGP program is a new program that is being developed consistent with GALL AMP XI.M32, "One-Time Inspection." This program includes measures to verify the effectiveness of the Plant Chemistry program and the Fuel Oil Chemistry program.

This program also confirms the absence of age degradation in selected components (e.g., flow restrictors, venturis, and small bore piping) within License Renewal scope. The MNGP One-Time Inspection program addresses concerns and confirmation for the potential long incubation period for certain aging effects on structures and components. There are cases where either (a) an aging effect is not expected to occur but there is insufficient data to completely rule it out or (b) an aging effect is expected to progress very slowly. The activities of the One-Time Inspection program include (a) determination of the sample size based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience; (b) identification of the inspection locations in the system or component based on the aging effect; (c) determination of the examination technique, including acceptance criteria that would be effective in managing the aging effect for which the component is examined; and (d) evaluation of the need for follow-up examinations to monitor the progression of any identified aging degradation. The program will manage the aging effects due to corrosion, cracking, erosion, fouling, fretting, or thermal exposure. The program will also verify the absence of reduction of neutron absorption capacity of boral in the spent fuel pool.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.23, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR USAR Supplement table and as required by 10 CFR 54.21(d).

2.23.7 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 USAR 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).

2.24 OPEN-CYCLE COOLING WATER SYSTEM (MNGP AMP B2.1.24)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.24, "Open-Cycle Cooling Water System," is an existing plant program that is consistent with GALL AMP XI.M20, "Open-Cycle Cooling Water System."

2.24.1 Program Description

The applicant states in the MNGP LRA that this program relies on the implementation of the recommendations of NRC Generic Letter (GL) 89-13 to ensure that the effects of aging on the raw water service water systems will be managed for the period of extended operation. This program manages the aging effects of metallic components in water systems (e.g., piping and heat exchangers) exposed to raw, untreated (e.g., service) water. These aging effects are due to corrosion, erosion, and biofouling in systems, structures and components serviced by the Open-Cycle Cooling Water system. The program includes (a) surveillance and control of biofouling, (b) tests to verify heat transfer, and (c) routine inspection and maintenance. These inspection and control techniques manage the aging effects caused by biofouling, corrosion, erosion, protective coating failures, and silting in these raw water systems. The MNGP Open-Cycle Cooling Water System program complies with MNGP's response to NRC GL 89-13. Resultant commitments made to comply with GL 89-13 have been incorporated into plant procedures and programs.

2.24.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that AMP B2.1.24 is consistent with the 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 report for MNGP AMP B2.1.24, including PBD/AMP-007, "Aging Management Program Basis Document - Open-Cycle Cooling Water System Program," Revision 1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M20.

The project team also reviewed the program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.24 and associated bases documents against the GALL AMP XI.M20 for consistency.

The project team reviewed those portions of the Open-Cycle Cooling Water System program for which the applicant claims consistent with GALL AMP XI.M20 and finds that they are consistent the GALL AMP. Furthermore, the project team concludes that the applicant's Open-Cycle Cooling Water System program provides reasonable assurance that the aging effects for which the program is credited will be adequately managed. The project team finds the applicant's Open-Cycle Cooling Water System program acceptable because it conforms to the recommended GALL XI.M20, "Open-Cycle Cooling Water System."

2.24.3 Exceptions to the GALL Report

None

2.24.4 Enhancements

None

2.24.5 Operating Experience

The applicant states in the MNGP LRA that its Open-Cycle Cooling Water System program has been effective in managing loss of material and heat transfer degradation aging effects for systems within the scope of the program. Program effectiveness has been demonstrated by various self-assessments and Nuclear Oversight Department reviews. These assessments have shown that the MNGP has implemented the requirements of GL 89-13. Corrosion and material condition issues have been documented and evaluated in the site Corrective Action program. Corrective actions have been effective in addressing corrosion and other material condition issues of piping and components. Thus, there is reasonable assurance that the Open-Cycle Cooling Water System program manages aging effects so that the systems, structures, and components within the program scope will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

The project team reviewed the operating experience provided in the MNGP 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 on discussions with the applicant's technical staff, the project team concludes that applicant's open-cycle cooling water system program will adequately manage the aging effects that are identified in the MNGP LRA for which this AMP is credited.

### 2.24.6 USAR Supplement

The applicant provides its USAR Supplement for the Open-Cycle Cooling Water System in the MNGP LRA, Appendix A, Section 2.1.24, which states that the MNGP Open-Cycle Cooling Water System program relies on the implementation of the recommendations of NRC Generic Letter (GL) 89-13 to ensure that the effects of aging on the raw water service water systems will be managed for the period of extended operation. This program manages the aging effects of metallic components in water systems (e.g., piping and heat exchangers) exposed to raw, untreated (e.g., service) water. These aging effects are due to corrosion, erosion, and biofouling in systems, structures, and components serviced by the Open-Cycle Cooling Water system. The program includes (a) surveillance and control of biofouling, (b) tests to verify heat transfer, and (c) routine inspection and maintenance. The MNGP Open-Cycle Cooling Water System program complies with MNGP's response to NRC GL 89-13. Resultant commitments made to comply with GL 89-13 have been incorporated into plant procedures and programs.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.24, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR USAR Supplement table and as required by 10 CFR 54.21(d).

### 2.24.7 Conclusion

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

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

## 2.25 PLANT CHEMISTRY (MNGP AMP B2.1.25)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.25, "Plant Chemistry Program," is an existing plant program that is consistent with GALL Report AMP XI.M2, “Water Chemistry ,” with exceptions.

2.25.1 Program Description

The applicant states in the MNGP LRA that the Plant Chemistry program mitigates the aging effects on component surfaces that are exposed to water as the process fluid. Chemistry programs are used to control water chemistry for impurities (e.g., chloride and sulfate) that accelerate corrosion or crack initiation and growth and that cause heat transfer degradation due to fouling in select heat exchangers. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below system-specific limits based on BWRVIP-130 (EPRI TR-1008192): BWR Water Chemistry Guidelines - 2004 Revision. BWRVIP-130 supersedes previous revisions of the BWR Water Chemistry Guidelines, including BWRVIP-29 (TR-103515, 1993 Revision). For low-flow or stagnant portions of a system, a one-time inspection of selected components at susceptible locations provides verification of the effectiveness of the Plant Chemistry program.

The MNGP LRA notes that Section 4.6.1 of the USAR gives the Design Basis for the Plant Chemistry program**.** The presence of oxygen generated by radiolytic decomposition of water produces an environment favoring intergranular stress corrosion cracking (IGSCC) of the components exposed to the coolant. This mode of degradation can be controlled by suppressing the dissolved oxygen concentration with hydrogen injection and by maintaining high purity reactor coolant water. This process is called hydrogen water chemistry (HWC). The HWC system was installed in accordance with the recommendations of the BWR Owners Group, “Guidelines for Permanent BWR Hydrogen Water Chemistry Installation -1987 Revision.” The NRC accepted these guidelines by letter dated July 13, 1987, and issued Safety Evaluation Reports on the Monticello design on January 7, 1988, and February 13, 1989. The hydrogen water chemistry system is not safety related. Equipment and components are not class 1E or environmentally qualified. The hydrogen and oxygen piping are designed and installed in accordance with ANSI B 31.1 (1977 Edition with all addenda through Winter 1978 Addendum). Where this piping is routed in the proximity of safety-related equipment, the piping is supported in accordance with Class I seismic requirements, and hangers are classified as II over I.

2.25.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.25 is consistent with GALL Report AMP XI.M2, with exceptions.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.25, including PDB/AMP-001, “Aging Management Program Basis Document - Plant Chemistry Program,” Revision 1, which provides an assessment of the AMP elements' consistency with GALL Report AMP XI.M2.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.25 and associated program bases documents against the GALL AMP XI.M2 for consistency.

The project team reviewed those portions of the Plant Chemistry program for which the applicant claims consistent with GALL Report AMP XI.M2 and finds that the applicant is consistent the with the GALL Report. Each program element in MNGP AMP B2.1.25 and associated program attribute assessment documents was evaluated and compared to the corresponding element in GALL AMP XI.M2. The project team found that, but for the exception noted by the applicant, they are consistent with the GALL Report. Furthermore, the project team concludes that the applicant's Plant Chemistry program provides reasonable assurance that Plant Chemistry program will manage the aging effects for components within the scope of license renewal during the period of extended operation. The project team finds the applicant's Plant Chemistry program acceptable because it conforms to the recommended GALL Report AMP XI.M2, "Water Chemistry Program," with the exceptions as described below.

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

The applicant states in the MNGP LRA that the exceptions to the GALL Report elements are as follows:

<u>Exception 1</u>

Element: 1: Scope of Program

Exception: The MNGP Plant Chemistry Program uses BWRVIP-130 (EPRI TR-1008192); BWR Water Chemistry Guidelines – 2004 Revision. BWRVIP-130 supersedes previous revisions of the BWR Water Chemistry Guidelines, including BWRVIP-29 (TR-103515).

Based on technical analysis, the NRC found the provisions of EPRI TR-103515-R2, BWR Water Chemistry Guidelines-2000 Revision, acceptable because the program is based on updated industry experience. EPRI TR-1008192 is the current update of the BWR Water Chemistry Guidelines and supersedes TR-103515-R2. EPRI TR-1008192 is based on updated industry experience, with increased emphasis on fuel performance concerns, while retaining chemistry parameters, Action Levels and associated measurement frequencies essentially unchanged.

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

> The program includes periodic monitoring and control of known detrimental contaminants such as chlorides, fluorides (PWRs only), dissolved oxygen, and sulfate concentrations below the levels known to result in loss of material or crack initiation and growth. Water chemistry control is in accordance with the guidelines in BWRVIP-29 (EPRI TR-103515) for water chemistry in BWRs; EPRI TR-105714, Rev. 3 and PWRs; EPRI TR102134, Rev. 3, for primary water chemistry in PWRs; EPRI TR-102134, Rev. 3, for secondary water chemistry in PWRs; or later revisions or updates of these reports as approved by the staff.

The MNGP LRA Section B2.1.25 states this program has one exception in that the MNGP Plant Chemistry program uses the 2004 Revision (not the 1993, 1996, or 2000 Revisions) of the EPRI

BWR Water Chemistry Guidelines.   BWRVIP-130 (TR-1008192) – 2004 Revision replaced the BWRVIP-79 (TR-103515-R2), BWR Water Chemistry Guidelines - 2000 Revision. This MNGP Plant Chemistry personnel state that the new program incorporates updated industry experience with increased focus on fuel performance, while retaining chemistry parameters, Action Levels, and associated measurements frequencies essentially unchanged. The project team interviewed MNGP Plant Chemistry personnel on how the existing Plant Chemistry program the elements of BWRVIP-29 and compare against the 2000 revision of the Water Chemistry Guidelines.  Based on the MNGP Plant Chemistry personnel response, the Plant Chemistry program has the elements of BWRVIP-29 and  incorporates updated guidelines based on industry experience.  The project team comparison of the EPRI 2000 Revision against the EPRI 2004 Revision, used by MNGP, also shows that the guideline was updated to show industry experience.

Based on the documentation of these chemistry revisions, the project team determines that no significant changes to critical program elements have resulted in adopting the 2004 Revision (BWRVIP-130) and the technical basis and guidance were updated to reflect additional industry experience with increased focus on fuel performance, whiling retaining chemistry parameters, action levels, and associated measurements frequencies.  Therefore, the project team found the exception to be acceptable.

<u>Exception 2</u>

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| Element: | 2: Parameters Monitored/Inspected |
| Exception: | The MNGP Plant Chemistry Program does not measure hydrogen peroxide.  Instead, site-specific radiolysis modeling is performed.  As noted in EPRI TR-1008192, reliable measurements of hydrogen peroxide are exceptionally difficult to obtain, and concentration can be estimated from radiolysis models. |

The GALL Report identifies the following recommendation for “parameters monitored/inspected” program elements associated with the exception taken:

> *BWR Water Chemistry:* The guidelines in BWRVIP-29 (EPRI TR-103515) for BWR reactor water recommend that the concentration of chlorides, sulfates, and dissolved oxygen are monitored and kept below the recommended levels to mitigate corrosion.  The two impurities, chlorides and sulfates, determine the coolant conductivity; dissolved oxygen, hydrogen peroxide, and hydrogen determine electrochemical potential (ECP).  The EPRI guidelines recommend that the coolant conductivity and ECP are also monitored and kept below the recommended levels to mitigate SCC and corrosion in BWR plants.  The EPRI guidelines in BWRVIP-29 (TR-103515) for BWR feedwater, condensate, and control rod drive water recommends that conductivity, dissolved oxygen level, and concentrations of iron and copper (feedwater only) are monitored and kept below the recommended levels to mitigate SCC. The EPRI guidelines in BWRVIP-29 (TR-103515) also include recommendations for controlling water chemistry in auxiliary systems: torus/pressure suppression chamber, condensate storage tank, and spent fuel pool

The applicant states, in the MNGP LRA, that the Plant Chemistry program indicates site-specific monitoring of hydrogen peroxide is not performed. As noted in Section 8.2.1.13 of ERPI TR-1008192, decomposition of water to oxygen occurs rapidly, making reliable data difficult to obtain. Concentrations can, instead, be estimated from radiolysis models. MNGP uses radiolysis models as the basis for establishing hydrogen injection rates to effectively reduce the level of oxidant in the reactor coolant and minimize the potential for stress corrosion cracking.

The project team interviewed the applicant to provide technical justification as to why MNGP initially used reactor vendor models as the basis for Hydrogen Water Chemistry. Since then, EPRI developed a software program as part of the BWR Vessels and Internals Project (BWRVIP), which is now used by MNGP to perform radiolysis and electrochemical potential (ECP) for specific regions inside the reactor vessel (BWR Vessels and Internal Application – BWRVIA). Results from this model have been compared to prior reactor vendor models to confirm appropriate application of the software modeling applications. The model is run at least twice during each operating cycle to account for changes in reactor flux and core flow on model results.

The project team finds in its evaluation and review of plant specific operating experience that the exception to the Plant Chemistry program to not measure hydrogen peroxide, but instead, use a site-specific radiolysis modeling is acceptable and consistent with the GALL Report based on the fact that radiolysis models are an acceptable method for establishing hydrogen injection rates (to reduce oxidants in the RCS and thus SCC) as established by EPRI Guidelines for BWR vessel internals.

On the basis of the review of the above exception and review of operating experience and the applicant's technical responses for the MNGP AMP B2.1.25 program (see Section 2.25.5, below), the project team finds this exception to be acceptable.

2.25.4 <u>Enhancements</u>

None

2.25.5 <u>Operating Experience</u>

The applicant states, in the MNGP LRA, that the MNGP Plant Chemistry program has been effective in monitoring and controlling water chemistry and in performing its function in mitigating aging effects. Based on a review of condition reports/action requests, the plant has taken timely and effective corrective action when limits were not met to resolve abnormal conditions. Condition reports/action requests are initiated when water chemistry is found to be out of specification. Many of these conditions are the result of equipment or plant transient conditions (e.g., plant startup) that are resolved once the transient condition subsides. The time duration of these conditions is typically short, and no evidence of detrimental equipment impacts could be found. Further, no examples of component functional failures due to corrosion, cracking, or heat transfer degradation resulting from inadequate chemistry control were identified.

The applicant, during the audit and review, provided technical material on the question of components replaced due to IGSCC. This Operating Experience noted that several components susceptible to IGSCC were replaced (entire Recirculation System Piping, a number of safe ends connected to the reactor vessel, the jet pump hold down assembly and shroud head bolts). In a discussion with MNGP technical staff, the other components mentioned in the GALL Report were addressed. Aging management of IGSCC for the core shroud, access hole cover, top guide, core spray spargers, and other reactor vessel internals are addressed by the BWR Vessels Internal Aging Management Program. These components were evaluated against Industry experience related to IGSCC issues and have been addressed by component replacements with less susceptible materials, implementation of Hydrogen Water Chemistry, and improvements in water chemistry standards. The entire Recirculation System piping, a number of safe ends connected to the reactor vessel, the jet pump hold down beam assemblies, and the shroud head bolts were replaced with materials less susceptible to IGSCC.

Based on technical data provided by the applicant, the project team found no adverse trends in water chemistry control were identified based on a review of various chemistry performance indicators. Established procedural requirements for chemistry limits are based on EPRI and industry standards and routinely monitored by the MNGP Chemistry staff. Recent external and internal assessments have identified chemistry trending as a strength and personnel knowledge as good. These conclusions are based on a review by the project team of Corrective Action Program issues on Chemistry (and out of specification chemistry limits) from January 1, 1996, through May 1, 2004; recent external and internal Chemistry Department assessment results; system health reports; and chemistry performance indicators and trends.

The project team reviewed the operating experience provided in MNGP 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 operating experience and discussions with the applicant's technical staff, the project team concludes that the applicant's AMP B.2.1.25 will adequately manage the aging effects that are identified in MNGP LRA for which this AMP is credited.

2.25.6 USAR Supplement

The applicant provides its USAR Supplement for the Plant Chemistry program in the MNGP LRA, Appendix A, Section 2.1.25. which states that the MNGP Plant Chemistry program mitigates the aging effects on component surfaces that are exposed to water as the process fluid. Chemistry programs are used to control water chemistry for impurities (e.g., chloride and sulfate) that accelerate corrosion or crack initiation and growth and that cause heat transfer degradation due to fouling in select heat exchangers. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below system-specific limits based on BWRVIP-130 (EPRI TR-1008192): BWR Water Chemistry Guidelines - 2004 Revision. BWRVIP-130 supersedes previous revisions of the BWR Water Chemistry Guidelines including BWRVIP-29 (TR-103515, 1993 Revision). For low-flow or stagnant portions of a system, a One-time Inspection of selected components at susceptible locations provides verification of the effectiveness of the Plant Chemistry program.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.25, finds it 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).

2.25.7 Conclusion

On the basis of its audit and review 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 exceptions and the associated justifications and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3). The project team also reviewed the USAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.26 PRIMARY CONTAINMENT INSERVICE INSPECTION (MNGP AMP B2.1.26)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.26, "Primary Containment Inservice Inspection Program," is an existing plant program that is consistent with GALL AMP XI.S1, "ASME Section XI, Subsection IWE."

### 2.26.1 Program Description

The applicant states, in the MNGP LRA, that this program conforms to the applicable requirements of 10CFR50.55a and the 1992 Edition with 1992 Addenda of the ASME Boiler and Pressure Vessel Code, Subsection IWE.

The MNGP Primary Containment Inservice Inspection Program requires visual examinations of the accessible surfaces (base metal and welds) of the drywell, torus, vent lines, internal vent system, penetration assemblies and associated integral attachments. The program also requires examination of pressure retaining bolting and the dry well interior slab moisture barrier.

A detailed VT-3 and VT-1 examination is performed once during each 10-year inservice inspection interval. This examination is performed either at the end of the interval or spread across the three periods that comprise the interval. General visual examinations that assess overall structural condition are performed once during each period.

Surface and / or volumetric examination augments visual examination as required to define the extent of observed conditions or to identify deterioration at inaccessible locations. Limited scope examinations are performed as required to evaluate disassembled bolting and the condition of the normally submerged torus surface when the suppression pool is drained.

The program is updated periodically as required by 10 CFR50.55a.

### 2.26.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.26 is consistent with the GALL AMP XI.S1.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.26, including Aging Management Program Basis Document, PBD/AMP-022, Revision 1, "Primary Containment

Inservice Inspection Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.S1.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.26 and associated bases documents against the GALL AMP XI.S1 for consistency.

The applicant states in MNGP AMP B2.1.26 that exceptions to ASME Code requirements that have been granted by approved Code Cases or relief requests are not considered to be exceptions to NUREG-1801 criteria. In addition, a number of relief requests are cited in the discussion of some program elements. In all cases, it is reiterated that these are not considered exceptions since the MNGP IWE program has been reviewed by the NRC and is in accordance with 10 CFR 50.55a with NRC-approved relief requests.

The project team noted that 10 CFR 50.54 dictates that the license renewal application must contain information for each structure and component within the scope of license renewal concerning the demonstration 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.

The project team questioned the applicant's position that exceptions to ASME code requirements that have been granted by Code Cases or Relief Requests are not considered to be exceptions to the GALL Report.

In a letter dated August 31, 2005 (ML052500294), the applicant states that:

> The statement under the "NUREG-1801 Consistency" regarding "Exceptions to ASME Code requirements that have been granted by approved Code Cases or relief requests are not considered to be exceptions to NUREG-1801 criteria" should be removed. The statement is not required. ASME Section XI, Subsection IWE alternatives expire prior the period of extended operation.
>
> The statement under the "Scope of Program" regarding "These are not considered exceptions since the MNGP program has been reviewed by the NRC and is in accordance with 10CFR50.55a with NRC approved relief requests" should be removed. The statement is not required. ASME Section XI, Subsection IWE alternatives expire prior the period of extended operation.
>
> The statement under the "Parameters Monitored or Inspected" regarding "These are not considered exceptions since the MNGP program has been reviewed by the NRC and is in accordance with 10CFR50.55a with NRC approved relief requests" should be removed. The statement is not required. ASME Section XI, Subsection IWE alternatives expire prior the period of extended operation.
>
> The statement under the "Detection of Aging Effects" regarding "This is not considered an exception since the MNGP program has been reviewed by the NRC and is in accordance with 10CFR50.55a with NRC approved relief requests" should be removed. The statement is not required. ASME Section XI, Subsection IWE alternatives expire prior the period of extended operation.

The statement under the “Monitor and Trending” regarding “This is not considered an exception since the MNGP program has been reviewed by the NRC and is in accordance with 10CFR50.55a with NRC approved relief requests” should be removed. The statement is not required. ASME Section XI, Subsection IWE alternatives expire prior the period of extended operation.

The statement under the “Corrective Actions” regarding “This is not considered an exception since the MNGP program has been reviewed by the NRC and is in accordance with 10CFR50.55a with NRC approved relief requests” should be removed. The statement is not required. ASME Section XI, Subsection IWE alternatives expire prior the period of extended operation.

The statement under the “Confirmation Process” regarding “This is not considered an exception since the MNGP program has been reviewed by the NRC and is in accordance with 10CFR50.55a with NRC approved relief requests” should be removed. The statement is not required. ASME Section XI, Subsection IWE alternatives expire prior the period of extended operation.

The project team found the applicant’s position acceptable.

The project team reviewed those portions of the Primary Containment Inservice Inspection program for which the applicant claims consistent with GALL AMP XI.S1 and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant’s Primary Containment Inservice Inspection program provides reasonable assurance that aging of structures systems and components within the scope of the program will be adequately managed during the period of extended operation. The project team finds the applicant’s Primary Containment Inservice Inspection program acceptable because it conforms to the recommended GALL XI.S1, “ASME Section XI, Subsection IWE."

2.26.3 Exceptions to the GALL Report

None

2.26.4 Enhancements

None

2.26.5 Operating Experience

The applicant states, in the MNGP LRA, that the Primary Containment Inservice Inspection program, when implemented in conjunction with the 10 CFR 50, Appendix J program and special examinations conducted to address specific industry issues, has demonstrated that aging of the primary containment, the internal vent system and steel components within the torus is managed in an effective manner. Special examinations have verified the absence of significant corrosion in the drywell sand pocket region and on the normally submerged surfaces of the torus. Leakage testing has been effective in early detection of passive isolation barrier (active barriers are outside the scope of the aging management program) deterioration. Inservice inspection program examinations have shown that there is no significant corrosion on, or other deterioration of, accessible containment shell, vent system and penetration assembly surfaces.

The applicant also states that considering plant experience in implementing the Primary Containment Inservice Inspection program, it may be concluded that this program, when complemented by the 10 CFR 50, Appendix J program, will provide reasonable assurance that primary containment, internal vent system and steel components within the torus aging effects are effectively managed throughout the period of extended operation.

The project team reviewed the operating experience provided in MNGP 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 operating experience and on discussions with the applicant's technical staff, the project team concludes that the Primary Containment Inservice Inspection Program will adequately manage the aging effects that are identified in MNGP LRA for which the AMP is credited.

2.26.6 USAR Supplement

The applicant provides its USAR Supplement for the Primary Containment Inservice Inspection program in the MNGP LRA, Appendix A, Section 2.1.26, which states that the MNGP Primary Containment Inservice Inspection program requires visual examinations of the accessible surfaces (base metal and welds) of the drywell, torus, vent lines, internal vent system, penetration assemblies and associated integral attachments. The program also requires examination of pressure retaining bolting and the drywell interior slab moisture barrier.

The program conforms to the applicable requirements of 10CFR50.55a and the 1992 Edition with 1992 Addenda of the ASME Boiler and Pressure Vessel Code, Subsection IWE.

A detailed VT-3 and VT-1 examination is performed once during each 10-year inservice inspection interval. This examination is performed either at the end of the interval or spread across the three periods that comprise the interval. General visual examinations that assess overall structural condition are performed once during each period.

Surface and/or volumetric examination augments visual examination as required to define the extent of observed conditions or to identify deterioration at inaccessible locations.

Limited scope examinations are performed as required to evaluate disassembled bolting and the condition of the normally submerged torus surface when the suppression pool is drained.

The program is updated periodically as required by 10 CFR50.55a.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.26, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR USAR Supplement table and as required by 10 CFR 54.21(d).

2.26.7 Conclusion

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

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

## 2.27 PROTECTIVE COATING MONITORING & MAINTENANCE (MNGP AMP B2.1.27)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.27, "Protective Coating Monitoring & Maintenance Program," is an existing plant program that is consistent with GALL AMP XI.S8, "Protective Coating Monitoring and Maintenance Program" with enhancements.

### 2.27.1 Program Description

The applicant states in the MNGP LRA that this program applies to Service Level 1 protective coatings inside containment to address the concerns of NRC GL 98-04, Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System after a Loss-of-Cooling Accident because of Construction and Protective Coating Deficiencies and Foreign Material in Containment. The Protective Coating Monitoring and Maintenance program prevents the degradation of coatings that could lead to the clogging of ECCS suppression pool suction strainers. MNGP does not credit the Protective Coating Monitoring and Maintenance program for the prevention of corrosion of carbon steel components.

As outlined in MNGP's response to GL 98-04, the Protective Coating Monitoring and Maintenance program is a comparable program for monitoring and maintaining protective coatings inside the primary containment and subject to the requirements of ANSI N101.4-1972 to the extent specified in ANSI N18.7-1976 and as modified by Regulatory Guide 1.54, June 1973.

### 2.27.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.27 is consistent with GALL AMP XI.S8, with enhancements.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.27, including PBD/AMP-029, "Aging Management Program Basis Document - Protective Coating Monitoring & Maintenance Program," which provides an assessment of the AMP elements' consistency with GALL AMP XI.S8.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.27 and associated bases documents against the GALL AMP XI.S8 for consistency.

The project team reviewed those portions of the Protective Coating Monitoring & Maintenance program for which the applicant claims consistent with GALL AMP XI.S8 and finds that they are consistent the GALL Report AMP. Furthermore, the project team concludes that the applicant's Protective Coating Monitoring & Maintenance program provides reasonable assurance that aging effects will be managed so that the structures and structural components within the scope of this program will continue to perform their intended functions consistent through the period of extended operation.  The project team finds the applicant's Protective Coating Monitoring & Maintenance program acceptable because it conforms to the recommended GALL XI.S8, "Protective Coating Monitoring and Maintenance Program" with the enhancements as described below.

2.27.3  Exceptions to the GALL Report

None

2.27.4  Enhancements

The applicant states in the MNGP LRA that the enhancements in meeting the GALL Report elements are as follows:

Enhancement 1

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| Element: | 1: Scope of Program |
| Enhancement: | The MNGP Protective Coating Maintenance and Monitoring program procedures will be updated to include inspection of all accessible painted surfaces inside containment. |

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

> The minimum scope of the program is Service Level I coatings, defined in RG 1.54, Rev 1, as follows: Service Level I coatings are used in areas inside the reactor containment where the coating failure could adversely affect the operation of post-accident fluid systems and thereby impair safe shutdown.

The applicant states, in the MNGP LRA, that the MNGP Protective Coating Maintenance and Monitoring program provides for inspections of the drywell and torus interior coated surfaces. The torus inspections include both above and below water surface inspections.  The program will be enhanced to include all accessible interior coated surfaces.

The project team noted that the GALL Report also states that a comparable program for monitoring and maintaining protective coatings inside containment, developed in accordance with RG 1.54, Rev. 0 or the American National Standards Institute (ANSI) standards (since withdrawn) referenced in RG 1.54, Rev. 0, and coatings maintenance programs described in licensee responses to NRC Generic Letter (GL) 98-04, is also acceptable as an aging management program (AMP) for license renewal.  The MNGP program is a "Comparable Program" as defined above.  The project team determined that this enhancement (i.e., requiring an inspection of all accessible painted surfaces inside containment) brings this attribute into conformance with the GALL Report recommendation of Service Level 1 coatings as defined in RG 1.54 Rev. 1.  On the basis of the above review and its review of operating experience for the MNGP AMP B2.1.27 program (see Section 2.27.5, below), the project team finds this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 2

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| Element | 4: Detection of Aging Effects |
| Enhancement: | Prior to the period of extended operation all coating inspectors will meet the requirements of ANSI N45.2.6. |

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

> ASTM D 5163-96, paragraph 5, defines the inspection frequency to be each refueling outage or during other major maintenance outages as needed. ASTM D 5163-96, paragraph 8, discusses the qualifications for inspection personnel, the inspection coordinator, and the inspection results evaluator. ASTM D 5163-96, subparagraph 9.1, discusses development of the inspection plan and the inspection methods to be used. It states, "A general visual inspection shall be conducted on all readily accessible coated surfaces during a walk-through. After a walk-through, thorough visual inspections shall be carried out on previously designated areas and on areas noted as deficient during the walk-through. A thorough visual inspection shall also be carried out on all coatings near sumps or screens associated with the Emergency Core Cooling System (ECCS). This subparagraph also addresses field documentation of inspection results. ASTM D 5163-96, subparagraph 9.5, identifies instruments and equipment needed for inspection.

The project team review noted that there was a requirement in the relevant ASTM that coating inspectors be qualified in accordance with ANSI N45.2.6 or the requirements of the ASTM. The team queried the MNGP personnel about the qualification requirement for inspection personnel. The applicant agreed that this enhancement would be added. By letter dated August 11, 2005 (ML052280269), the applicant has stated that prior to the period of extended operation all coating inspectors will meet the requirements of ANSI N45.2.6. The project team has determined that this enhancement (i.e., requiring that all coating inspectors be qualified in accordance with ANSI N45.2.6) brings this attribute into conformance with the GALL Report recommendation of qualification to the requirements of ASTM D5163-96, paragraph 8, the for inspection personnel, the inspection coordinator, and the inspection results evaluator. On the basis of the above review and its review of operating experience for the MNGP AMP B2.1.27 program (see Section 2.27.5, below), the project team finds this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 3

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| Element | 5: Monitoring and Trending |
| Enhancement: | Include a pre-inspection review of the previous two inspection reports so that trends can be identified. |

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

> ASTM D 5163-96 identifies monitoring and trending activities in subparagraph 6.2, which specifies a pre-inspection review of the previous two monitoring reports, and in subparagraph 10.1.2, which specifies that the inspection report should prioritize repair areas as either needing repair during the same outage or postponed to future outages, but under surveillance in the interim period.

The applicant states in the MNGP LRA that currently the MNGP Protective Coatings Monitoring and Maintenance Program provides no trending. Since all coated surfaces are inspected each time, all previously identified areas with coating degradation, whether repaired or un-repaired, are monitored for further degradation. The program will be enhanced to include a pre-inspection review of the previous two inspection reports so that trends can be identified. Work orders are created to repair all areas noted as unacceptable. These repairs are performed during the same outage as the inspection, during the next outage or in the case of the torus, during the next torus draining.

The project team review has determined that this enhancement (i.e., a pre-inspection review of the previous two inspection reports so that trends can be identified) brings this attribute into conformance with the GALL Report recommendation above. On the basis of the above review and its review of operating experience for the MNGP AMP B2.1.27 program (see Section 2.27.5, below), 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.

<u>Enhancement 4</u>

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| Element | 6: Acceptance Criteria |
| Enhancement: | Implementation Procedures will be revised to include provisions for analysis of suspected reasons for coating failure. |

The GALL Report identifies the following recommendation for the "acceptance criteria" program element associated with the enhancement:

> ASTM D 5163-96, subparagraphs 9.2.1 through 9.2.6, 9.3 and9.4, contain guidance for characterization, documentation, and testing of defective or deficient coating surfaces. Additional ASTM and other recognized test methods are identified for use in characterizing the severity of observed defects and deficiencies. The evaluation covers blistering, cracking, flaking, peeling, delamination, and rusting. ASTM D 5163-96, paragraph 11, addresses evaluation. It specifies that the inspection report is to be evaluated by the responsible evaluation personnel, who prepare a summary of findings and recommendations for future surveillance or repair, including an analysis of reasons or suspected reasons for failure. Repair work is prioritized as major or minor defective areas. A recommended corrective action plan is required for major defective areas so that these areas can be repaired during the same outage, if appropriate.

The applicant states in the MNGP LRA that the protective coatings inspection acceptance criteria are based on ASTM specifications D610, D660, D661, D662, D714, D772, D821, and D913. The procedures also indicate that if unacceptable surface areas are identified, then a

Section XI, VT-3 examination is performed. If the VT-3 examination identifies unacceptable surface areas, then the area is to be repaired using the work order process or an engineering evaluation per Section XI, IWE-3122.4 is performed. All repairs are done during the same outage as the inspection unless it is determined that the repairs can wait to the next outage or in the case of the torus, the next torus draining. Implementing procedures will be enhanced to include provisions for analysis of suspected reasons for coating failure.

The project team review has determined that this enhancement (i.e., Implementation Procedures will be revised to include provisions for analysis of suspected reasons for coating failure) brings this attribute into conformance with the GALL Report recommendation of including an analysis of reasons or suspected reasons for failure. On the basis of the above review and its review of operating experience for the MNGP AMP B2.1.27 program (see Section 2.27.5, below), 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.

2.27.5 Operating Experience

The applicant states in the MNGP LRA that the Protective Coating Monitoring and Maintenance program is not relied upon to manage loss of material due to corrosion of carbon steel structural elements. Therefore, only the operating experience concerned with degradation of coatings and their consequential clogging of the ECCS strainers is of importance. Since there currently are no coating inspection requirements for all components inside containment, the only inspection experience to date is those inspections of the drywell and torus shells. Inspections of the drywell and torus shell have identified the following signs of paint degradation: chipping, rusting, peeling, blistering, cracking, and other signs of degradation. All unacceptable coating degradation has been repaired or in the case of the torus is scheduled for repair during the next torus draining. These inspections have detected and evaluated aging effects prior to loss of intended function of the ECCS suction strainers. Where applicable, repairs were made such that further degradation of the coatings, which may lead to clogging of the ECCS suction strainers, would be minimized. As the existing inspection programs have been effective in correcting the minor coating issues identified to date (which have not impacted ECCS operation), there is reasonable assurance the enhanced inspection program will effectively manage the impact of coatings inside the containment to prevent adverse impact on ECCS suction strainer operation."

The project team reviewed the operating experience provided in MNGP 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 on discussions with the applicant's technical staff, the project team concludes that MNGP AMP B.2.1.27 adequately manages the aging effects that are identified in the MNGP LRA for which this AMP is credited.

2.27.6 USAR Supplement

The applicant provides its USAR Supplement for the Protective Coating Monitoring and Maintenance program in a letter dated June 10, 2005, Enclosure 2, Appendix A, Section A2.1.27, which states that the MNGP Protective Coating Monitoring and Maintenance program applies to Service Level 1 protective coatings inside containment to address the concerns of NRC GL 98-04, Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System after a Loss-of-Cooling Accident because of Construction and Protective Coating Deficiencies and Foreign Material in Containment. The Protective Coating Monitoring and Maintenance program prevents the degradation of coatings that could lead to the clogging of ECCS suppression pool suction strainers. MNGP does not credit the Protective Coating Monitoring and Maintenance program for the prevention of corrosion of carbon steel components.

As outlined in MNGP's response to GL 98-04, the Protective Coating Monitoring and Maintenance program is a comparable program for monitoring and maintaining protective coatings inside the primary containment and subject to the requirements of ANSI N101.4-1972, to the extent specified in ANSI N18.7-1976 and as modified by Regulatory Guide 1.54, June 1973.

Section A2.1.27 also states that prior to the period of extended operation, the MNGP Protective Coating Maintenance and Monitoring Program:
1) Procedures will be updated to include Inspection of all accessible painted surfaces inside containment;
2) Will be revised to include a pre-inspection review of the previous two inspection reports so that trends can be identified; and
3) Implementation procedures will be revised to include provisions for analysis of suspected reasons for coating failure.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.27, 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 USAR Supplement table and as required by 10 CFR 54.21(d).

#### 2.27.7 Conclusion

On the basis of its audit and review 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 enhancements and determined that the implementation of the enhancements prior to the period of extended operation would result in the existing aging management program being consistent with the GALL Report 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 USAR supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

### 2.28 REACTOR HEAD CLOSURE STUDS (MNGP AMP B2.1.28)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.28, "Reactor Head Closure Studs," is an existing plant program that is consistent with GALL AMP XI.M3, "Reactor Head Closure Studs."

#### 2.28.1 Program Description

The applicant states in the MNGP LRA that this program is a part of the MNGP ASME, Section XI, Inservice Inspection Program. The Reactor Head Closure Stud Program is in accordance with ASME, Section XI, 1995 Edition through the 1996 Addenda, and includes within its scope the closure studs, nuts, washers, and bushings. This program provides for condition monitoring of the reactor head closure stud bolting. The preventive measures of Regulatory Guide (RG) 1.65, Materials and Inspections for Reactor Vessel Closure Studs, are applied in this program. The program is updated periodically as required by 10 CFR 50.55a.

2.28.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that AMP B2.1.28 is consistent with the GALL AMP XI.M3.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.28, including PBD/AMP-034, “Aging Management Program Basis Document - Reactor Head Closure Studs,” Revision 1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M3.

The project team also reviewed the program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.28 and associated bases document against the GALL AMP XI.M3 for consistency.

During the audit and review, the project team reviewed plant basis document PBD/AMP-034, Reactor Head Closure Studs, Revision 1, and determined that MNGP is committed to the use of RG 1.65. The preventive measures of the RG (i.e., periodic use of dry graphite lubricant DAG 156) are applied. The MNGP studs are non-plated, manganese phosphate coated SA540, Grade B23/24, Class 3 (ASME, Section II, Part A), with a minimum tensile strength of 145 Ksi. This is consistent with the recommendations of the GALL Report.

The project team also determined that MNGP is committed to the use of ASME, Section XI, 1995 Edition with Addenda through 1996. MNGP performs the volumetric, surface, and visual inspections of ASME, Section XI, to the studs, nuts, bushings, washers, and stud holes, including the flange threads, to detect discontinuities and flaws. VT-2 visual examination is performed during pressure tests to detect evidence of leakage. This is consistent with the recommendations of the GALL Report.

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

2.28.3 Exceptions to the GALL Report

None stated. However, during the audit, the project team noted that the applicant made the following statement in the MNGP LRA.

> Exceptions to ASME requirements that have been granted by approved Code Cases or relief requests are not considered to be exceptions to NUREG-1801 criteria.

The project team asked the applicant to clarify this statement. The applicant responded that it used a code case, N-307-2, "Revised Ultrasonic Examination Volume for Class 1 Bolting, Table IWB-2500-1, Examination Category B-G-1, When the Examinations Are Conducted From the End of the Bolt or Stud or From the Center-Drilled Hole," September 24, 1999, that applied to the reactor head closure studs. The applicant also uses ASME, Section XI, 2001 Edition, in lieu of the 1995 Edition with Addenda through 1996, for repair and replacement activities; this second exception will be discussed below. Code cases are used when a code user cannot or does not want to perform a particular code requirement; this is an allowed exception to the application of the code by the user and thus is an exception to the recommendations of the GALL Report. The project team determined that the code case used affected the GALL Report recommendation and determined that its use constituted an exception. In a letter dated August 11, 2005 (ML052280269), supplemented by a letter dated August 31, 2005 (ML052500294), the applicant stated that a change to the application will be made to identify the use of the code case as an exception to this AMP. The project team evaluation of these exceptions is provided below.

<u>Exception 1</u>

| | |
|---|---|
| Element: | 3: Parameters Monitored or Inspected |
| Exception: | When conducting ultrasonic examinations from the end of the stud to satisfy the examination requirements of ASME, Section XI, the examination volume may be limited to a cylinder of 1/4 inch thickness, measured from the minor diameter, and the length of the threaded portion of the stud. |

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

> The ASME, Section XI, ISI program detects and sizes cracks, detects loss of material, and detects coolant leakage by following the examination and inspection requirements specified in Table IWB-2500-1.

The project team confirmed that Code Case N-307-2 is listed in Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME, Section XI, Division 1," Revision 13, January 2004, Table 1. Based on this listing, this code case has been reviewed and accepted for general industry use by the NRC staff.

The project team then reviewed both the applicable ASME, Section XI, inservice inspection requirements for the reactor head closure studs and the alternative requirements of Code Case N-307-2, the pertinent code case. ASME, Section XI, requires the following examinations to be performed on the reactor head closure studs: a visual of the surfaces of the reactor head closure nuts, washers, and bushings; a volumetric of the vessel flange threads and reactor head closure stud, when examined in place; and a surface and volumetric of the reactor head closure stud, when removed. In lieu of the volume required to be examined by ASME, Section XI, which is essentially the entire volume of the reactor head closure stud, Code Case N-307-2 allows a volumetric examination of a cylindrical region of 1/4 inch thickness, measured from the minor diameter of the reactor head closure stud and the length of the threaded portion of the stud. The project team noted that the use of this code case reduces the required examination volume to the higher stress area of the bolting. The roots of the threads are stress risers and, hence, the preferred sites for crack initiation. Cracks at the roots of threads would be perpendicular to straight beam ultrasonic examination performed from the end of the stud and would create a corner trap for angle beam ultrasonic examination performed from the center hole. The project team reviewed the difference between the two requirements and noted the use of the code case altered the portion of the stud being examined but continued to identify the presence of the relevant aging effects (i.e., cracking and general corrosion) as the high stress portion of the stud continued to be examined. Thus, the project team determined that there was no impact on the aging effect being managed.

On the basis of a review of the above exception and of a review of operating experience for the MNGP AMP B2.1.14 program (see Section 2.14.5, below), the project team finds this exception to be acceptable.

<u>Exception 2</u>

Element: 7: Corrective Actions
Exception: An approved alternative allows the use of the 2001 Edition of ASME, Section XI, in lieu of the 1995 Edition with the 1996 Addenda for repair and replacement activities.

The GALL Report identified the following recommendations for the "corrective action" program element associated with the exception.

> For Class 1, 2, and 3, respectively, repair is in conformance with IWB-4000, IWC-4000, and IWD-4000, and replacement according to IWB-7000, IWC-7000, and IWD-7000. Approved BWRVIP-44 and BWRVIP-45 documents, respectively, provide guidelines for weld repair of nickel alloy and for weldability of irradiated structural components.

The applicant stated that the use of ASME, Section XI, 2001 Edition, as an alternative to ASME, Section XI, 1995 Edition with 1996 Addenda, for repair and replacement has already been generically reviewed and approved by the NRC staff for aging management of systems and components within the scope of license renewal. Therefore, this alternative will not affect the aging management of components crediting inservice inspection performed in accordance with ASME, Section XI. The applicant provided the following text, published in the *Federal Register*, Volume 67, No. 187, Thursday, September 26, 2002, Rules and Regulations.

> Accordingly, an applicant may use Subsections IWB, IWC, IWD, IWE, IWF, and IWL of the ASME Code (1997 Addenda, 1998 Edition, 1999 Addenda, and 2000 Addenda) as acceptable alternatives to the requirements of the 1995 Edition up to and including the 1996 Addenda of the ASME Code, Section XI, referenced in the GALL AMPS without the need to submit these alternatives for NRC review in its plant-specific license renewal application.
>
> The new limitations and modifications in 10 CFR 50.55a(b) require that the revised provisions be supplemented with additional inspection requirements as a condition for their use. The conclusions of the GALL Report remain valid for the

1997 Addenda, 1998 Edition, 1999 Addenda, and 2000 Addenda of Section XI with the use of these new limitations and modifications as discussed in this final rulemaking.

On the basis that this alternative, related to repair and replacement, has already been generically reviewed and approved by the NRC staff for aging management of systems and components within the scope of license renewal, the project team concluded that this item does not need to be classified as an exception and that the program element affected by it is consistent with the GALL Report.

2.28.4 Enhancements

None

2.28.5 Operating Experience

The applicant states, in the MNGP LRA, that this reactor head closure studs program is implemented through the ASME, Section XI, inservice inspection program, which monitors the condition of the reactor head closure studs and the associated stud components. The reactor head closure studs are implemented and maintained in accordance with the general requirements for engineering programs. This provides assurance that the program is effectively implemented to meet regulatory, process, and procedure requirements, including periodic reviews; qualified personnel are assigned as program managers and are given responsibility and sufficient authority to implement the program; and adequate resources are committed to program activities.

The applicant further states in the application that a search of condition reports and inservice inspection history was conducted, and no reports documenting deficiencies or problems with reactor head closure studs, associated stud components, or the reactor head closure studs program were found. Based on these results, the operating experience provides evidence that the program and maintenance practices are ensuring the continued integrity of the reactor head closure studs and associated stud components.

The project team interviewed the operating experience provided in the MNGP 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 reactor head closure stud program will adequately manage the aging effects that are identified in the MNGP LRA for which this AMP is credited.

2.28.6 USAR Supplement

The applicant provides its USAR Supplement for the Reactor Head Closure Studs program in the MNGP LRA, Appendix A, Section A2.1.28, which states that the MNGP reactor head closure studs program is credited for aging management of the reactor head closure studs and stud components by means of inservice inspection. The reactor head closure studs, nuts, washers, and bushings are included in the ASME, Section XI, Inservice Inspection program, 1995 Edition with Addenda through 1996. The reactor head closure studs program is consistent with the corresponding program described in the GALL Report.

The MNGP USAR Supplement specifies that this aging management program is credited for aging management of reactor head closure studs and stud components by means of inservice inspection. The MNGP USAR Supplement also specifies that the MNGP reactor head closure studs program is consistent with the preventive measures of Regulatory Guide 1.65, “Material and Inspection for Reactor Vessel Closure Studs.”

The project team reviewed the USAR Supplement for MNGP AMP B2.1.28, found that it was consistent with the GALL Report, and determined that it provides an adequate summary description of the program, as identified in the SRP-LR USAR Supplement table and as required by 10 CFR 54.21(d).

2.28.7 Conclusion

On the basis of its review and audit of the applicant’s program, the project team finds that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the project team has reviewed the exception and the associated justifications and determined that the AMP with the exception is adequate to manage the aging effects for which it is credited. The project team 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 USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d)

## 2.29 REACTOR VESSEL SURVEILLANCE (MNGP AMP B2.1.29)

This program is reviewed by NRR-DE staff and addressed in Section 3 of the SER related to the MNGP LRA.

## 2.30 SELECTIVE LEACHING OF MATERIALS (MNGP AMP B2.1.30)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.30, "Selective Leaching of Materials Program," will be implemented as a new program that is consistent with GALL AMP XI.M33, “Selective Leaching of Materials,” with exceptions.

2.30.1 Program Description

The applicant states, in the MNGP LRA, that this program will be developed and implemented before the start of the period of extended operation. The program includes a one-time visual inspection and hardness measurement of selected components that are susceptible to selective leaching. In situations where hardness testing is not practical, a qualitative method by other NDE or metallurgical methods will be used to determine the presence and extent of selective leaching. The program will determine if selective leaching is occurring for selected components. Any required instructions or procedures will be written during development of the program. Existing MNGP procedures or work instructions may be used.

The applicant also states in the MNPG LRA that this program ensures the integrity of components made of gray cast iron, bronze, brass, and other alloys exposed to a raw water, treated water, or ground-water environment that may lead to selective leaching of one of the metal components.

2.30.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.30 is consistent with GALL AMP XI.M33, with exceptions.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.30, including Aging Management Program Basis Document, PBD/AMP-020, “Selective Leaching of Materials,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.M33.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.30 and associated bases documents against GALL AMP XI.M33 for consistency.

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

2.30.3 Exceptions to the GALL Report

The applicant states, in the MNGP LRA, exceptions to the GALL report element as follows:

Element: 4: Detection of Aging Effects

Exceptions: 1) Hardness testing, other than Brinell hardness testing, may be used at the MNGP to identify the presence of selective leaching of material.

2) Qualitative methods will be used at the MNGP in lieu of hardness testing to determine if selective leaching has occurred in situations where hardness testing is not practical.

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

> The one-time visual inspection and hardness measurement includes close examination of a select set of components to determine whether selective leaching has occurred and whether the resulting loss of strength and/or material will affect the intended functions of these components during the period of extended operation.
>
> Selective leaching generally does not cause changes in dimensions and is difficult to detect. However, in certain brasses it causes plug-type dezincification, which can be

> detected by visual inspection. One acceptable procedure is to visually inspect the susceptible components closely and conduct Brinell hardness testing on the inside surfaces of the selected set of components to determine if service leaching has occurred. If it is occurring an engineering evaluation is initiated to determine acceptability of the affected components for further service.

The applicant states, in the MNGP LRA, that:

Exception (1) is justified because there are other acceptable hardness tests, besides Brinell, that can provide equivalent testing results for components within the scope of this program.

Exception (2) is justified because hardness testing may not be feasible for some components due to form and configuration (i.e., heat exchanger tubes), and hardness testing only provides definitive results if baseline values are available for comparison. The qualitative method used in lieu of the hardness test would typically be an enhanced visual inspection consistent with ASME Section XI, VT-1 requirements. This qualitative method will be augmented, as necessary, by other NDE or metallurgical methods, as appropriate.

The project team discussed these exceptions with the applicant's technical staff. Regarding Exception (1), the project team concurred that Brinell hardness testing is one of several methodologies that are currently being used and it is only a GALL recommendation. The project team found the applicant's position acceptable. Regarding Exception (2), the project team asked the applicant to provide a clarification pertaining to the use of qualitative methods versus hardness testing. In particular the project team was concerned that, metallurgical and other methods be used in addition to VT-1.

Through a letter dated August 11, 2005 (ML052280269), the applicant states that the methods to identify the presence of selective leaching are visual inspection in conjunction with mechanistic techniques such as scratch testing, hardness testing, or nondestructive examinations. The project team found the applicant's position acceptable.

On the basis of its review of operating experience for the Selective Leaching program (see Section 2.30.5, below) and the applicant's response in the letter dated August 11, 2005 (ML052280269), the project team finds these exceptions to be acceptable.

2.30.4 Enhancements

None

2.30.5 Operating Experience

The applicant states, in the MNGP LRA, that the MNGP Selective Leaching of Materials program is a new program and thus does not have any operating experience. The program's one-time inspections are consistent with standard industry practice and recommendations as outlined in the GALL Report.

The applicant also states that a review of MNGP condition reports for leaching identified a possible selective leaching issue. The condition report identified a higher than normal lead content in the 12 Emergency Diesel Generator (EDG) Lube Oil. A document review pointed out that INPO SOER 80-04 recommended that if lead soldered joint coolers are installed, inspections for exfoliation type solder corrosion should be made. A work history review determined that the 11 EDG lube oil cooler had been replaced with the rolled tube design in 1991, but that 12 EDG still had its original cooler. The Lube Oil Cooler for 12 EDG was replaced during the 2003 Refueling Outage with one with a rolled tube designed.

The project team recognizes that the corrective action program, which captures internal and external 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.

2.30.6 USAR Supplement

The applicant provides its USAR Supplement for the Selective Leaching of Materials Program in the MNGP LRA, Appendix A, Section 2.1.30. which states that the MNGP Selective Leaching of Materials Program will be a new program, developed and implemented before the start of the period of extended operation. The program is consistent, with exceptions, to the recommendations of NUREG-1801 Chapter XI Program M33, "Selective Leaching of Materials." The applicant has been committed to a one-time visual inspection and hardness measurement of selected components that are susceptible to selective leaching. In situations where hardness testing is not practical, a qualitative method by other NDE or metallurgical methods will be used to determine the presence and extent of selective leaching. The program will determine if selective leaching is occurring for selected components. Any required instructions or procedures will be written during development of the program. Existing MNGP procedures or work instructions may be used.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.30, 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 USAR Supplement table and as required by 10 CFR 54.21(d).

2.30.7 Conclusion

On the basis of its audit and review 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 exceptions and the associated justifications and determined that the AMP, with the exceptions is adequate to manage the aging effects for which it is credited. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3). The project team also reviewed the USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

## 2.31 STRUCTURES MONITORING (MNGP AMP B2.1.31)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.31, "Structures Monitoring Program," is an existing plant program that is consistent with GALL AMP XI.S6, "Structures Monitoring Program, XI.S5,"Masonry Wall Program," and XI.S7, "RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants," with enhancements.

2.31.1 Program Description

The applicant states, in the MNGP LRA, that this program provides for aging management of structures and structural components within the scope of license renewal and implements the GALL Report, XI.S6, Structures Monitoring program. The Structures Monitoring program is based on the guidance provided in RG 1.160 and NUMARC 93-01. The Structures Monitoring program is implemented as part of the structures monitoring done under the MNGP Maintenance Rule program and with additional inspections of the Intake Structure and Diesel Fuel Oil Transfer House.

The Structures Monitoring program also implements the GALL Report, XI.S5, “Masonry Wall Program.” Masonry block wall inspections are performed as part of the maintenance rule inspections and are based on IEB 80-11, “Masonry Wall Design,” with administrative controls per IN 87-67, “Lessons Learned from Regional Inspections of Licensee Actions in Response to IEB 80-11.”

In addition, the Structures Monitoring program implements the GALL Report, XI.S7, RG 1.127, “Inspection of Water-Control Structures Associated with Nuclear Power Plants.” The only water control structure in scope for license renewal is the Intake Structure, which includes the Access Tunnel and the Diesel Fire Pump House.” Maintenance rule inspections are performed on the portions of the Intake Structure above the water line. The Structures Monitoring Program includes separate inspections of the underwater portions of the Intake Structure.

Finally, special settlement checks of the Diesel Fuel Oil Transfer House are performed.

The Structures Monitoring Program does not rely upon protective coatings to manage the effects of aging.

2.31.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP AMP B2.1.31 is consistent with GALL AMP XI.S6, XI.S5, and XI.S7, with enhancements.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.31, including Aging Management Program Basis Document, PBD/AMP-027, “Structures Monitoring Program,” which provides an assessment of the AMP elements' consistency with GALL AMP XI.S6, XI.S5, and XI.S7.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.31 and associated basis document against the GALL AMP XI.S6, XI.S5, and XI.S7 for consistency.

The project team reviewed those portions of the Structures Monitoring Program for which the applicant claims consistent with GALL AMP XI.S6, XI.S5, and XI.S7, and finds that they are consistent the GALL AMPs. Furthermore, the project team concludes that the applicant’s Structures Monitoring Program provides reasonable assurance that the program will manage plant aging. The project team finds the applicant’s Structures Monitoring Program acceptable because it conforms to the recommended GALL AMP XI.S6, “Structures Monitoring Program, XI.S5, ”Masonry Wall Program,” and XI.S7, “RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants,” with the enhancements as described below.

2.31.3 Exceptions to the GALL Report

None

2.31.4 Enhancements

The applicant states, in the MNGP LRA, that the following enhancements are required to meet the GALL Report elements:

Enhancement 1

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| Element: | 1: Scope of Program |
| Enhancement: | The Structures Monitoring Program will be expanded, as necessary, to include inspections of structures and structural elements in scope for License Renewal that are not inspected as part of another aging management program. |

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

> AMP XI.S5 states that the scope includes all masonry walls identified as performing functions in accordance with 10 CFR 54.4.
>
> AMP XI.S7 states that RG 1.127 applies to water-control structures associated with emergency cooling water systems or flood protection of nuclear power plants. The applicant indicated that MNGP is not committed to RG 1.127. In this case, the inspections of water control structures are included in the Structures Monitoring Program, as recommended by GALL.

The applicant states in MNGP LRA that the Structures Monitoring program manages the aging effects of structures and structural components within the scope of License Renewal that are not covered by another management program. According to MNGP AMP B2.1.31, the Structures Monitoring program includes masonry block walls and water control structures that are in scope for license renewal. Water control structures, which include Access Tunnel and Diesel Fire Pump House, are listed within the Scope of Program.

On the basis of its review of operating experience for the MNGP AMP B2.1.31 program (see Section 2.31.5, below) and based on satisfying the GALL recommendations as discussed above, the project team finds this enhancement to be acceptable as such changes to the applicant’s program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 2

| | |
|---|---|
| Element: | 1: Scope of Program |

| | |
|---|---|
| Enhancement | Implementing procedures for the Structures Monitoring Program will be enhanced to ensure that structural inspections are performed on submerged portions of the Intake Structure from the service water bays to the wing walls. |

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

> The Water Control structures includes intake structures.

The applicant states in MNGP LRA that the Structures Monitoring Program includes separate inspections of the underwater portions of the Intake Structure. Under Scope of Program the applicant states that the program also provides inspection requirements to manage aging effects as described in Parameters Monitored Inspected. The AMP Basis Document states, under Parameters Monitored Inspected, that Procedures 4125-PM and 4126-PM require structural inspections of the service water bays. The applicant’s technical staff reiterated that program implementing activities 4125-PM, “East Service Water Bay Inspection/Dredging” and 4126-PM, “West Service Water Bay Inspection/Dredging” will be enhanced to include more detailed inspection criteria. The AMP Basis Document also states in the same section that during the period of extended operation, structural inspections of the submerged portions of the intake structure will be performed at a frequency which meets or exceeds that required by ACI 349.3R-96.

On the basis of its review of operating experience for the MNGP AMP B2.1.31 program (see Section 2.31.5, below) and based on satisfying the GALL recommendations as discussed above, 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.

<u>Enhancement 3</u>

| | |
|---|---|
| Element: | 3: Parameters Monitored/ Inspected |
| Enhancement: | Implementing procedures for the Structures Monitoring Program will be revised to include the monitoring/inspection parameters for structural components within the scope of License Renewal. |

The GALL Report identifies the following recommendations for “parameters monitored/inspected” program element associated with the enhancement:

> For general Structures Monitoring, ACI 349.3R-96 and ANSI/ASCE 11-90 provide an acceptable basis for selection parameters to be monitored or inspected for concrete or steel structures and other components within the scope of License Renewal. For Intake Structures concrete, parameters would include cracking, movements and erosion. For Masonry Walls, wall cracking and corrosion of structural steel supports should be included.

The applicant states, in the MNGP LRA, that existing procedures will be enhanced to include the monitoring/inspection parameters for all structural components within the scope of License Renewal. PBD/AMP-027, the Structures Monitoring Program Basis Document, which incorporates Intake Structures and Masonry Walls, was reviewed and it was confirmed that it was in general agreement with the above recommendations.

On the basis of its review of operating experience for the MNGP AMP B2.1.31 program (see Section 2.31.5, below) and based on satisfying the GALL recommendations as discussed above, the project team finds this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 4

| | |
|---|---|
| Element: | 3: Parameters Monitored/ Inspected |
| Enhancement: | The Structures Monitoring program will be enhanced to include a requirement to sample ground water for pH, chloride concentration and sulfate concentration. |

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

> pH >5.5, chlorides <500 ppm and sulfates <1500 ppm for non aggressive environment. These values were established as part of the Interim Staff Guidance 3.

The applicant states, in the MNGP LRA, that to ensure that the soil environment has remained non aggressive, the structures monitoring program will be enhanced to include periodic groundwater sampling for pH, chloride concentration and sulfate concentration. This is reiterated in the Program Basis Document where the limiting values of pH > 5.5, chlorides <500 ppm and sulfates<1500 ppm for non aggressive environment are provided.

On the basis of its review of operating experience for the MNGP AMP B2.1.31 program (see Section 2.31.5, below) and based on satisfying the GALL recommendations as discussed above, the project team finds this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 5

| | |
|---|---|
| Element: | 3: Parameters Monitored/ Inspected |
| Enhancement: | The Structures Monitoring Program will be enhanced to include concrete evaluations of inaccessible areas if degradation of accessible areas is detected. |

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

> Include concrete evaluations of inaccessible areas if degradation of accessible areas is detected.

The applicant states, in the MNGP LRA, that to ensure the soundness of buried concrete, the program will be enhanced to include concrete evaluations of inaccessible areas if degradation of accessible areas is detected.  This is reiterated in the Program Basis Document.

On the basis of its review of operating experience for the MNGP AMP B2.1.31 program (see Section 2.31.5, below) and based on satisfying the GALL recommendations as discussed above, the project team finds this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 6

| | |
|---|---|
| Element: | 4: Acceptance Criteria |
| Enhancement | Implementing procedures for the Structures Monitoring program will be enhanced to include acceptance criteria for structural inspections of submerged portions of the Intake Structure. |

The GALL Report identifies the following recommendation for "acceptance criteria" program element associated with the enhancement:

> Acceptance criteria based on Chapter 5 of ACI 349.3R-96 are acceptable.

The applicant states, in the MNGP LRA, that acceptance criteria of MNGP's submerged portions of intake structure will be established and included in implementing procedures.  The applicant's technical staff stated that for structural components of the Intake Structure in a raw water/river water environment, acceptance criteria will be based on relevant industry codes and standards.  ACI 349.3R-96 will be referenced for guidance on evaluating concrete degradation.

On the basis of its review of operating experience for the MNGP AMP B2.1.31 program (see Section 2.31.5, below) and based on satisfying the GALL recommendations as discussed above, 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.

The above enhancements have been docketed by NMC for MNGP as commitments 43 through 48. They are also listed in the USAR Supplement, Section 2.31.6.

2.31.5  Operating Experience

The applicant states in the MNGP LRA that the Structures Monitoring program, including the Masonry Block Wall Program and the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants and implemented through the Maintenance Rule and other procedures has detected aging effects of structural components and has ensured that repairs were made in a timely manner prior to loss of intended function.  External operating experience is also evaluated for impact on structures and structural inspections through administrative procedures and the corrective action process.

The two most recent inspections, performed in 1998 and 2001/2002, noted several deficiencies. The 1998 inspection noted 21 deficiencies, and the 2001/2002 inspection noted 30 deficiencies.

However, not all of these deficiencies were directly attributed to an aging effect. The aging effects detected during the structural inspections were concrete spalling, cracking, surface deterioration and flaking, grout deterioration, corroded rebar or other steel components and cracked welds. Work orders and/or corrective actions were created to repair the deficiencies. Several deficiencies were evaluated and determined to be acceptable as-is and subjected to further inspections.

The project team reviewed the operating experience provided in MNGP 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 MNGP LRA for which this AMP is credited.

2.31.6 USAR Supplement

The applicant provides its USAR Supplement for the Structures Monitoring program in a letter dated June 10, 2005, Enclosure 2, Appendix A, Section A2.1.31, which states that the Structures Monitoring program provides for aging management of structures and structural components within the scope of license renewal and implements the NUREG-1801, XI.S6, Structures Monitoring program. The Structures Monitoring program is based on the guidance provided in RG 1.160 and NUMARC 93-01. The Structures Monitoring program is implemented as part of the structures monitoring done under the MNGP Maintenance Rule program and with additional inspections of the intake structure and diesel fuel oil transfer house.

The Structures Monitoring program also implements the NUREG-1801, XI.S5, Masonry Wall Program. Masonry block wall inspections are performed as part of the maintenance rule inspections and are based on IEB 80-11 with administrative controls per IN 87-67.

In addition, the Structures Monitoring program implements the GALL Report, XI.S7, “RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants.” The only water control structure in scope for license renewal is the Intake Structure, which includes the Access Tunnel and the Diesel Fire Pump House.” Maintenance rule inspections are performed on the portions of the Intake Structure above the water line. The Structures Monitoring Program includes separate inspections of the underwater portions of the Intake Structure.

Finally, special settlement checks of the diesel fuel oil transfer house are performed.

The Structures Monitoring program does not rely upon protective coatings to manage the effects of aging.

Section 2.1.31 also states that prior to the period of extended operation:

1. The program will be expanded, as necessary, to include inspections of structures and structural elements in scope for License Renewal that are not inspected as part of another aging management program.

2. Implementing procedures will be enhanced to ensure that structural inspections are performed on submerged portions of the Intake Structure from the service water bays to the wing walls.

3. Implementing procedures will be revised to include the monitoring/inspection parameters for structural components within the scope of License Renewal.

4. The program will be enhanced to include a requirement to sample ground water for pH, chloride concentration and sulfate concentration.

5. The program will be enhanced to include concrete evaluations of inaccessible areas if degradation of accessible areas is detected.

6. Implementing procedures will be enhanced to include acceptance criteria for structural inspections of submerged portions of the Intake Structure.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.31, 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 USAR Supplement table and as required by 10 CFR 54.21(d).

#### 2.31.7 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. Also, the project team has reviewed the enhancements and determined that the implementation of the enhancements prior to the period of extended operation would result in the existing aging management program being consistent with the GALL Report 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 USAR Supplement for this AMP and finds that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

### 2.32 SYSTEM CONDITIONING MONITORING (MNGP AMP B2.1.32)

This program is reviewed by NRR-DE staff and addressed in Section 3 of the SER related to the MNGP LRA.

### 2.33 THERMAL AGING AND NEUTRON EMBRITTLEMENT OF CAST AUSTENITIC STAINLESS STEEL (CASS) (MNGP AMP B2.1.33)

In MNGP LRA, Appendix B, Section B2.1, the applicant states that MNGP AMP B2.1.33, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)," is an existing plant program that is consistent with GALL AMP XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)."

2.33.1 Program Description

The applicant states, in the MNGP LRA, that this program monitors the aging effects of loss of fracture toughness on the intended function of the component by performing examinations on CASS reactor vessel internal components as part of the MNGP ASME Section XI Inservice Inspection Program. The Thermal Aging and Neutron Irradiation Embrittlement of CASS program is in accordance with ASME Section XI, Subsection IWB, Category B-N-1 and B-N-2 requirements and provides for condition monitoring of the CASS components. Additional enhanced visual inspections that incorporate the requirements of the BWRVIP are performed to detect the effects of loss of fracture toughness due to thermal aging and neutron irradiation embrittlement of CASS reactor vessel internals.

2.33.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that AMP B2.1.33 is consistent with the GALL AMP XI.M13.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B2.1.33, including PBD/AMP-004, “Aging Management Program Basis Document - Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program,” Revision 1, which provides an assessment of the AMP elements' consistency with GALL AMP XI.M13.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B2.1.33 and associated bases documents against GALL AMP XI.M13 for consistency. During the audit and review, the project team asked the applicant whether its current approved ISI relief requests or code cases affect any of the program elements of its aging management programs. The applicant identified the alternative to use the 2001 Edition of ASME Section XI for repair/replacement as an exception to the “corrective action” program element of the GALL AMP XI.M13. The project team’s evaluation of this exception is documented in Section 2.33.3 of this report.

During the audit and review, the project team asked the applicant regarding the screening criteria for determining the susceptibility of CASS components to thermal aging. The applicant stated that MNGP does not address this screening process; instead, all CASS reactor vessel internal components are included in the MNGP AMP B2.1.33 program. These components consist of jet pump assembly castings, the orifice fuel support casting, and the guide tube base casting. The project team finds this approach is conservative and therefore acceptable.

The project team reviewed those portions of the Thermal Aging and Neutron Irradiation Embrittlement of CASS program for which the applicant claims consistent with GALL AMP XI.M13 and finds that they are consistent the GALL AMP. Furthermore, the project team concludes that the applicant’s Thermal Aging and Neutron Irradiation Embrittlement of CASS program provides reasonable assurance that the aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation. The project team finds the applicant’s Thermal Aging and Neutron Irradiation Embrittlement of CASS program acceptable because it conforms to the recommended GALL XI.M13, “Thermal Aging and Neutron Irradiation Embrittlement of CASS."

### 2.33.3 Exceptions to the GALL Report

During the audit and review, the project team asked the applicant whether its current approved ISI relief requests or code cases affect any of the program elements of its aging management programs. In a letter dated August 31, 2005 (ML052500294), the applicant identified the following exception to the GALL Report program element:

Element: 7: Corrective Actions
Exception: An approved alternative allows the use of the 2001 Edition of ASME Section XI in lieu of the 1995 Edition with the 1996 Addenda for repair/ replacement activities.

The GALL Report Identifies the following recommendations for the “corrective action” program element associated with the exception taken:

> Repair and replacement procedures are equivalent to those requirements in the ASME Section XI. Repair is in conformance with IWB-4000 and replacement occurs according to IWB-7000. As discussed in the appendix to this report, the staff finds that licensee implementation of the guidelines in BWRVIP-48, as modified, will provide an acceptable level of quality for inspection and flaw evaluation of the safety-related components addressed in accordance with 10 CFR Part 50, Appendix B, corrective actions.

The applicant states that the alternative [to use the 2001 Edition of ASME Section XI for repair/ replacement] has already been generically reviewed and approved by the NRC staff for aging management of systems and components within the scope of license renewal and therefore this alternative will not affect the aging management of components crediting ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD. The applicant provides the following text and states that it was published in the *Federal Register*/Volume 67, No. 187/Thursday, September 26, 2002/Rules and Regulations:

> Accordingly, an applicant may use Subsections IWB, IWC, IWD, IWE, IWF, and IWL of the ASME BPV Code (1997 Addenda, 1998 Edition, 1999 Addenda, and 2000 Addenda) as acceptable alternatives to the requirements of the 1995 Edition up to and including the 1996 Addenda of the ASME Code, Section XI, referenced in the GALL AMPS without the need to submit these alternatives for NRC review in its plant-specific license renewal application.
>
> The new limitations and modifications in 10 CFR 50.55a(b) require that the revised provisions be supplemented with additional inspection requirements as a condition for their use. The conclusions of the GALL Report remain valid for the 1997 Addenda, 1998 Edition, 1999 Addenda, and 2000 Addenda of Section XI of the BPV Code with the use of these new limitations and modifications as discussed in this final rulemaking.

Based on the fact that this alternative, as it relates to repair and replacement, has already been generically reviewed and approved by the NRC staff for aging management of systems and components within the scope of license renewal, the project team concluded that this item does not need to be classified as an exception, and that with regard to this item, the program element affected by it is consistent with the GALL Report.

2.33.4 Enhancements

None

2.33.5 Operating Experience

The applicant states, in the MNGP LRA, that the Thermal Aging and Neutron Irradiation Embrittlement of CASS program has been effective in managing aging effects due to thermal aging and neutron irradiation embrittlement. Materials within the scope of the program are periodically examined and evaluated for corrective action as needed. In addition to ASME inspection requirements, vendor guidance (e.g., BWRVIP-03 and 41) is followed.
.
During the audit and review, the project team reviewed the MNGP's ISI summary report for Cycle 21 and No. 21 refuel outage. The project team noted that adequate inspections had been performed on those components listed in the scope of MNGP Thermal Aging and Neutron Embrittlement of CASS program, with no unacceptable findings. In addition, the project team reviewed the operating experience provided in MNGP 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 operating experience and on discussions with the applicant's technical staff, the project team concludes that MNGP AMP B.2.1.33 will adequately manage the aging effects that are identified in MNGP LRA for which this AMP is credited.

2.33.6 USAR Supplement

The applicant provides its USAR Supplement for the Thermal Aging and Neutron Irradiation Embrittlement of CASS program in MNGP LRA, Appendix A, Section 2.1.33, which states that the MNGP program monitors the aging effects of loss of fracture toughness on the intended function of the component by performing examinations on CASS reactor vessel internal components as part of the MNGP ASME Section XI, Inservice Inspection Program. The Thermal Aging and Neutron Irradiation Embrittlement of CASS program is in accordance with ASME Section XI, Subsection IWB, Category B-N-1 and B-N–2 requirements and provides for condition monitoring of the CASS components. Additional enhanced visual inspections that incorporate the requirements of the BWRVIP are performed to detect the effects of loss of fracture toughness due to thermal aging and neutron irradiation embrittlement of CASS reactor vessel internals. The applicant also states that the program is updated periodically as required by 10 CFR 50.55a.

The project team reviewed the USAR Supplement for MNGP AMP B2.1.33, 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).

2.33.7 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 USAR 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).

## 2.34 ENVIRONMENTAL QUALIFICATION (EQ) OF ELECTRICAL COMPONENTS (MNGP AMP B3.1)

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

### 2.34.1 Program Description

The applicant states in the MNGP LRA that the purpose of this program is to ensure that safety-related electrical equipment is capable of performing its function in a harsh environment (effects of a loss of coolant accident [LOCA], high-energy line break, or post LOCA radiation) and is qualified in accordance with the Equipment Qualification Final Rule, 10 CFR 50.49. This program describes the EQ program attributes and how those attributes ensure that the EQ program remains effective throughout the license renewal period (60 years).

### 2.34.2 Consistency with the GALL Report

In the MNGP LRA, the applicant states that MNGP EQ Program is an existing program, established to meet the commitments of 10 CFR 50.49, that is consistent with the GALL AMP X.E1.

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B3.1, including (a) PBD/AMP-042, Revision 1, “Aging Management Program Basis Document - Electrical Equipment Subject to 10 CFR 50.49 Environmental Qualification (EQ) Requirements,” which provides an assessment of the AMP elements' consistency with GALL AMP X.E1, and (b) LRA Section 4.7, “Environmental Qualification of Electrical Equipment (EQ),” which describes the important attributes (analytical methods, underlying assumptions, acceptance criteria, and corrective actions) for reanalysis of the aging evaluation of electrical components included as part of the EQ program.

The project team also reviewed seven program elements (see Section 1.5.1 of this report) contained in the MNGP AMP B3.1 and associated bases documents against the GALL AMP X.E1 for consistency. In addition, the project team reviewed the four program elements for reanalysis of the aging evaluation for electrical components described in MNGP LRA Section 4.7 against the GALL AMP X.E1 for consistency.

During the audit and review, the project team asked the applicant to provide the supporting bases documents associated with the four program elements for reanalysis of the aging evaluation for electrical components described in LRA Section 4.7. The applicant was unable to located the supporting bases documents; therefore, the project team limited its review for consistency with GALL AMP X.E1 to information presented in MNGP LRA Section 4.7.

The project team reviewed those portions of the environmental qualification (EQ) program for which the applicant claims consistency with the AMP X.E1 in the GALL Report and determined that they are consistent the GALL Report. Furthermore, the project team concluded that the applicant’s environmental qualification (EQ) program is adequate for managing component thermal, radiation, and cyclical aging through the use of aging evaluations based on 10 CFR50.49(f) qualification methods.

On the basis of its review and discussion with the applicant’s staff, the project team finds this AMP acceptable because it conforms to the recommended program description, program elements, and acceptance criteria for GALL AMP X.E1, “Environmental Qualification (EQ) of Electric Components.” The project team finds that those program elements for which the applicant claims consistency within the GALL AMP X.E1 are consistent with the GALL Report.

2.34.3 Exceptions to the GALL Report

None

2.34.4 Enhancements

None

2.34.5 Operating Experience

The applicant states in the MNGP LRA that the EQ Program includes monitoring and assessment of industry information to assess its impact on EQ components at the MNGP. The EQ Coordinator is responsible for reviewing the disposition of such information, as well as subsequent assignment of actions to be taken, and confirming that completion of the actions has satisfactorily addressed potential MNGP EQ aging issues. The following examples provide objective evidence that the MNGP EQ program is responsive to externally identified operating experience items as well as proactive in self identification activities:

- NRC Safety System Design Inspection, March 2003, resulted in two green findings and four corrective actions.

- Nuclear Oversight Quality Assurance Assessment, June 2003, resulted in no findings.

- 2001 Internal Self-Assessment resulted in determination of effective implementation but noted specific areas needing improvement and additional recommendations for continued improvement.

- Program Health Reports include program health reviews which are periodically performed to measure the acceptability of the program and identify improvements as applicable in accordance with MNGP and NMC Fleet Procedures.

- Operating Experience Reviews of EQ issues identified at other sites are processed through the Corrective Action Program.

On the basis of its review of the above operating experience and on discussions with the applicant's technical staff, the project team concludes that MNGP AMP B.3.1 adequately manages the aging effects that have been observed at the applicant's plant.

2.34.6 USAR Supplement

The applicant provides its USAR Supplement for the environmental qualification (EQ) program in the MNGP LRA, Appendix A, Sections A3.9 and A4.1. Section A4.1 states that the purpose of the MNGP EQ Program is to ensure that safety-related electrical equipment is capable of performing its function in a harsh environment (effects of a loss of coolant accident [LOCA], high-energy line break [HELB], or post LOCA radiation) and is qualified in accordance with the Equipment Qualification Final Rule, 10 CFR 50.49, dated February 22, 1983. The MNGP program will continue through the end of the 20-year period of extended operation. Section A3.9 provides a summary description of the EQ program and aging evaluations of electrical components in the EQ program that specify a qualified life of at least 40 years and are TLAAs for license renewal. Reanalysis of an aging evaluation to extend the qualification of components under 10 CFR 50.49(e) is performed as part of the EQ Program at MNGP. Important aspects of a reanalysis include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria, and corrective actions (if acceptance criteria are not met). Continued effective implementation of the program provides reasonable assurance that (a) the aging effects will be managed and (b) EQ components will continue to perform their intended function(s) consistent with the current licensing basis for the period of extended operation. Therefore, the MNGP EQ Program is an acceptable aging management program for license renewal under 10 CFR 54.21(c)(1)(iii) during the period of extended operation.

The project team reviewed the USAR Supplement for EQ of electrical equipment at MNGP, 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, as required by 10 CFR 54.21(d).

2.34.7 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 consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

On the basis of its review of the USAR 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).

## 2.35 METAL FATIGUE OF THE REACTOR COOLANT PRESSURE BOUNDARY (MNGP AMP B3.2)

In MNGP LRA, Appendix B, Section B3.2, the applicant states that MNGP AMP B3.2, "Metal Fatigue of the Reactor Coolant Pressure Boundary," is an existing plant program that is consistent with GALL AMP X.M1, “Metal Fatigue of Reactor Coolant Pressure Boundary” with enhancement.

2.35.1 Program Description

The applicant states, in the MNGP LRA, that this program is part of the MNGP Thermal Fatigue Monitoring program. The MNGP Thermal Fatigue Monitoring program provides for the periodic review of plant transients for impacts on selected components. In addition, environmental effects have been evaluated in accordance with NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves for Selected Nuclear Power Plant Components." Selected components were evaluated using material specific guidance presented in NUREG/CR-6583 for carbon and low alloy steels and in NUREG/CR-5704 for austenitic stainless steels. The MNGP program ensures that limiting components remain within the acceptance criteria for cumulative fatigue usage throughout the licensed term and, if trends indicate otherwise, appropriate corrective action can be implemented.

2.35.2 Consistency with the GALL Report

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

The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report for MNGP AMP B3.2, including MNGP PBD/AMP-043, Revision 1, "Aging Management Program Basis Document - Metal Fatigue of the Reactor Coolant Pressure Boundary," which provides an assessment of the AMP elements' consistency with GALL AMP X.M1. The project team also reviewed GE Nuclear report GE-NE-0000-0020-02779-01, "Time-Limited Aging Analyses – Reactor Vessel and Internals, Monticello Nuclear Generating Plant," Revision 0; and applicant's documents, CA-04-143, "Environmental Fatigue Calculations for NUREG/CR-6260," Revision 12; CA-01-116, "Documentation of Thermal Cycles," Revision 13; and EWI-08.07.01, "Engineering Work Instruction – Thermal Fatigue Monitoring Program," Revision 0.

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

The project team reviewed those portions of the Metal Fatigue of the Reactor Coolant Pressure Boundary Program for which the applicant claims consistent with GALL AMP X.M1 and finds that they are consistent with the GALL AMP. Furthermore, the project team concludes that the applicant's Metal Fatigue of the Reactor Coolant Pressure Boundary program provides reasonable assurance that cumulative fatigue usage values for limiting reactor coolant pressure boundary components will be appropriately evaluated, tracked, and trended throughout the period of extended operation so that if trends indicate otherwise, appropriate corrective action can be implemented. The project team finds the applicant's Metal Fatigue of the Reactor Coolant Pressure Boundary program acceptable because it conforms to the recommended GALL X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary," with the enhancements as described below.

2.35.3 Exceptions to the GALL Report

None

2.35.4 Enhancements

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

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|---|---|
| Element: | 1: Scope of Program |
| Enhancement: | Incorporate requirements for inclusion of NUREG/CR-6260 locations in implementing procedures for the MNGP Thermal Fatigue Monitoring program. |

During the audit and review, the project team noted that this enhancement also affects the “monitoring and trending” program element as described in GALL X.M1, “Metal Fatigue of Reactor Coolant Pressure Boundary.”

The GALL Report identifies the following recommendation for the “scope of program” program element associated with the enhancement:

> The program includes preventive measures to mitigate fatigue cracking of metal components of the reactor coolant pressure caused by anticipated cyclic strains in the material.

The GALL Report identifies the following recommendation for the “monitoring and trending” program element:

> The program monitors a sample of high fatigue usage locations. As a minimum, this sample is to include the locations identified in NUREG/CR-6260.

The project team finds that the applicant’s enhancement to MNGP AMP B3.2, to include all NUREG/CR-6260 locations in implementing procedures for the MNGP Thermal Fatigue Monitoring program, is necessary to ensure consistency with GALL Report AMP description, and is acceptable.

During the audit and review, the project team asked the applicant whether MNGP has plant-specific locations where fatigue cumulative usage factors (CUFs) are projected to be higher than the values projected for NUREG/CR-6260 locations. In response to this question, the applicant stated that there are other areas projected to have cumulative fatigue usage values higher than locations evaluated for NUREG/CR-6260 locations and that the other areas are identified in the LRA and have been identified as acceptable in accordance with 10 CFR 54.21(c)(1)(iii). The applicant stated that MNGP’s Fatigue Monitoring program will be revised to include these locations as well as the NUREG/CR-6260 locations. The applicant stated that fatigue evaluations conducted in accordance with this program are updated on a once per cycle basis and are projected to a 60-year end of life (eol) and that if any locations are projected to exceed the code acceptance criteria for fatigue, appropriate actions will be taken to correct the situation prior to its occurrence.

The project team reviewed the applicant’s response together with the applicable section of the MNGP LRA. On the basis that both the most limiting locations and all of the applicable NUREG/CR-6260 locations are included in the applicant’s Fatigue Monitoring Program, the project team found the applicant’s response to be acceptable.

The project team asked the applicant whether MNGP intends to implement more detailed local monitoring to compute actual fatigue usage for limiting components. In response to this question, the applicant stated that all locations for fatigue considerations as identified in LRA Section 4 (TLAAs) have been shown to have reasonable margin to allowable (<1.0) when projected to the end of the LR term of operations (60) years. The applicant stated that they view these evaluations as conservative, but they are considering implementation of a computerized transient data gathering and fatigue evaluation tool to more accurately assess the impact of these transients in the event that increased margin becomes necessary due to an unplanned event. The applicant stated that they expect to complete their internal evaluation and begin implementation, if deemed appropriate, this year (2005).

The project team reviewed the applicant's response together with the applicable section of the LRA. On the basis that all limiting locations for fatigue considerations have been projected to the end of the license renewal term and shown to have adequate margin, the project team found the applicant's response to be acceptable.

The project team asked the applicant to provide additional information about environmental fatigue evaluations and to explain MNGP's basis for selecting locations where the effects of coolant environment on component fatigue life are included in the evaluation. In response to this request, the applicant stated that MNGP used the component locations in NUREG/CR-6260 and that those locations are based on an industry review of locations with generally high fatigue usage and/or importance from a risk perspective. The applicant stated that NUREG/ CR-6260 notes that these locations are not necessarily those with the highest fatigue usage; however, as a group they are considered to be an adequate sample of locations for environmental fatigue evaluations if all evaluations are shown to be in compliance with fatigue acceptance criteria (CUF<1.0). The applicant stated that although these locations are not necessarily the highest in terms of fatigue, they are high enough to be reasonably representative since the associated fatigue analyses contain conservatisms similar to those used for other locations. The applicant stated that if any environmental fatigue evaluation exceeds the acceptance criteria for the 60-year extended operating period, consideration of other locations is required. The applicant stated that all locations identified in NUREG/CR-6260 as representative for plants like MNGP have been evaluated and found to meet environmental fatigue acceptance criteria (see LRA Section 4.5). The applicant stated that the current environmental fatigue evaluations which have been projected to the end of the license renewal term of operation (60 years) are adequate for plant representation without augmentation to other locations.

The project team reviewed the applicant's response together with the applicable parts of NUREG/CR-6260. On the basis that MNGP includes consideration of environmental fatigue for all applicable points identified in NUREG/CR-6260, and the current environmental fatigue evaluations have been projected to the end of the license renewal term of operation and are acceptable, the project team found the applicant's response to be acceptable.

The applicant states in the MNGP LRA that the enhancement is required to satisfy the GALL Report recommendations and that enhancements are scheduled for completion prior to the period of extended operation. On the basis of its evaluation of the applicant's enhancement as described above and the review of operating experience for the MNGP AMP B3.2 program (see Section 2.35.5, below), 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.

2.35.5 <u>Operating Experience</u>

The applicant states in the MNGP LRA that the MNGP technical staff monitors industry operating experience through peer groups, industry information, and by communications with other plants subject matter experts.  Information from these sources are evaluated for impact on the MNGP Reactor Coolant Pressure Boundary Metal Fatigue program.  In addition, MNGP's technical staff updates internal operating experience to account for operating cycles and their effects on fatigue of limiting components on a frequency of at least once per refueling cycle. The MNGP LRA also states that this ensures the adequacy of the fatigue monitoring program in terms of providing a periodic means of evaluating fatigue margins and establishing corrective action plans as necessary.

The project team reviewed the operating experience provided in MNGP 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 evaluation of the applicant's program against the GALL Report's recommendations, its review of the above industry and plant-specific operating experience, and its discussions with the applicant's technical staff, the project team concludes that the applicant's Metal Fatigue of Reactor Coolant Pressure Boundary program will adequately manage the aging effects that are identified in MNGP LRA for which this AMP is credited.

2.35.6  USAR Supplement

The applicant provides its USAR Supplement for the Metal Fatigue of the Reactor Coolant Pressure Boundary program in a letter dated June 10, 2005, Enclosure 2, Appendix A, Section A4.2, which states that the MNGP program is a part of the MNGP Thermal Fatigue Monitoring program.  The MNGP Thermal Fatigue Monitoring program provides for the periodic review of plant transients for impact on selected components.  In addition, MNGP has evaluated environmental effects in accordance with NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves for Selected Nuclear Power Plant Components."  Selected components were evaluated using material specific guidance presented in NUREG/CR-6583 for carbon and low alloy steels and in NUREG/CR-5704 for austenitic stainless steels.  The MNGP program ensures that limiting components remain within the acceptance criteria for cumulative fatigue usage throughout the licensed term and, that if trends indicate otherwise, appropriate corrective action can be implemented.

The project team reviewed the USAR Supplement for MNGP AMP B3.2, 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 USAR Supplement table and as required by 10 CFR 54.21(d).

2.35.7  Conclusion

On the basis of its audit and review 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 enhancement and determined that the implementation of the enhancement prior to the period of extended operation would result in the existing aging management program being consistent with the GALL Report 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 USAR 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 Reviews Audit and Review Results

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

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

The AMR results that are within the scope of the project team are identified in Appendix D of the MNGP audit plan. These AMR result line items reviewed by the project team in Chapter 3 of the MNGP 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 the MNGP LRA Tables 3.X.2-Y, in addition to the notes, the applicant provided a summary of AMRs 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 its MNGP LRA.

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

Report. The project team reviewed these line-items to verify consistency with the GALL Report. The project team concluded that the AMR line-item of the different component was applicable to the component under review. The project team concluded that the identified exceptions to the GALL AMPs are acceptable.

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

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

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

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

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

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

Discrepancies or issues 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 docketed prior to issuing this audit and review report, a request for additional information (RAI) was prepared by the project team to solicit the information needed to disposition the issue. The RAI will be included and dispositioned in the SER related to the MNGP 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 MNGP LRA program bases documents, which are available at the applicant's engineering office and through interviews with MNGP 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 AMRs results review of MNGP LRA Sections 3.1 through 3.6 performed by the project team is provided in the following sections.

## 3.1 MNGP LRA Section 3.1 - Aging Management of Reactor Vessel, Internals, and Reactor Coolant System

### 3.1.1 Summary of Technical Information in the LRA

In Section 3.1 of the MNGP LRA, the applicant provided the results of its AMRs for the reactor coolant system. In Tables 3.1.2-1 through 3.1.2-5 in the applicant provided a summary of the AMRs for components/commodities in the (1) reactor head vent system; (2) reactor pressure vessel; (3) reactor vessel internals; (4) reactor recirculation system; and (5) reactor vessel instrumentation system. The summary information for each component type included intended function; material; environment; aging effect requiring management; AMPs; the GALL Report Volume 2 item; cross reference to the LRA Table 3.1.1 (Table 1); and generic and plant-specific notes related to consistency with the GALL Report.

Also the applicant identified for each component type in the LRA Table 3.1.1 those components that are consistent with the GALL Report, those that are consistent with the GALL Report in which further evaluation is recommended, and those that are not consistent with or not addressed in the GALL Report together with the basis of their exclusion.

### 3.1.2 Project Team Evaluation

The project team conducted its audit in accordance with SRP-LR Section 3.1.3 and the MNGP audit plan. The project team interviewed the applicant's technical project team and reviewed, in whole or in part the documents listed in Attachment 5 of this report.

Table 3.1-1 presents the project team evaluation for reactor vessel, internals, and reactor coolant system components in the GALL Report.

#### 3.1.2.1 Aging Management Review Results That Are Consistent with the GALL Report

For AMRs that the applicant states are consistent with the GALL Report, the project team conducted its audit and review to determine if the applicant's references to the GALL Report in the MNGP LRA are acceptable.

**Table 3.1-1 Project Team Evaluation for Reactor Vessel, Internals, and Reactor Coolant System Components in the GALL Report**

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Reactor coolant pressure boundary components (Item Number 3.1.1- 01) | Cumulative fatigue damage | TLAA, evaluated in accordance with 10 CFR 54.21(c) | TLAA | This TLAA is evaluated in Section 4.3, Metal Fatigue (See Section 3.1.2.2.1) |
| 3.1.1- 02 | PWR Only | | | |
| Isolation Condenser (Item Number 3.1.1-03) | Loss of material due to general, pitting, and crevice corrosion | Plant specific | Not Applicable; MNGP does not use an isolation condenser | Further discussion is provided in subsection 3.1.2.2.2.2 |
| Pressure vessel ferritic materials that | Loss of fracture toughness due to neutron | TLAA, evaluated in accordance with Appendix G | TLAA | This TLAA is evaluated in Section 4.2, |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| have a neutron fluence greater than 10E17 n/cm2 (E>1 MeV) (Item Number 3.1.1- 04) | irradiation embrittlement | of 10 CFR 50 and RG 1.99 | | Reactor Vessel Neutron Embrittlement (See Section 3.1.2.2.3.1) |
| Reactor vessel beltline shell and welds (Item Number 3.1.1- 05) | Loss of fracture toughness due to neutron irradiation embrittlement | Plant specific | Reactor Vessel Surveillance Program (B2.1.29) | Consistent with GALL Report, which recommends further evaluation (See Section 3.1.2.2.3.2) |
| 3.1.1- 06 | PWR Only | | | |
| Small-bore reactor coolant system and connected systems piping (Item Number 3.1.1- 07) | Crack initiation and growth due to stress corrosion cracking (SCC), intergranular stress corrosion cracking (IGSCC), and thermal and mechanical loading | Inservice inspection; water chemistry; one-time inspection | ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Program (B2.1.2), Plant Chemistry Program (B2.1.25), and One-Time Inspection Program (B2.1.23) | Consistent with GALL Report, which recommends further evaluation (See Section 3.1.2.2.4.1) |
| Jet pump sensing line and reactor vessel flange leak detection line (Item Number 3.1.1-08) | Crack initiation and growth due to SCC, IGSCC, or cyclic loading | Plant specific | Jet pump sensing line not in scope. See 3.1.1-07 for reactor vessel flange leak detection system. | Consistent with GALL Report, which recommends further evaluation (See Section 3.1.2.2.4.2) |
| Isolation Condenser (Item Number 3.1.1-09) | Crack initiation and growth due to SCC or cyclic loading | Plant specific | Not Applicable; MNGP does not use an isolation condenser | Further discussion provided in section 3.1.2.2.4.3 |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| 3.1.1- 10 | PWR Only | | | |
| 3.1.1- 11 | PWR Only | | | |
| 3.1.1- 12 | PWR Only | | | |
| 3.1.1- 13 | PWR Only | | | |
| 3.1.1- 14 | PWR Only | | | |
| 3.1.1- 15 | PWR Only | | | |
| 3.1.1- 16 | PWR Only | | | |
| 3.1.1- 17 | PWR Only | | | |
| 3.1.1- 18 | PWR Only | | | |
| 3.1.1- 19 | PWR Only | | | |
| 3.1.1- 20 | PWR Only | | | |
| 3.1.1- 21 | PWR Only | | | |
| Reactor vessel closure studs and stud assembly (Item Number 3.1.1- 22) | Crack initiation and growth due to SCC and/or IGSCC | Reactor head closure studs | Reactor Head Closure Studs Program (B2.1.28) | Consistent with GALL Report. |
| CASS pump casing and valve body (Item Number 3.1.1-23) | Loss of fracture toughness due to thermal aging embrittlement | Inservice inspection | Inservice inspection (B2.1.2) | Consistent with GALL Report, after resolution of an LRA discrepancy (See Section 3.1.2.1.1) |
| CASS piping (Item Number 3.1.1-24) | Loss of fracture toughness due to thermal aging embrittlement | Thermal aging embrittlement of CASS | Not Applicable; MNGP does not have CASS piping in RCS | Based on applicant's statement in the LRA that MNGP does not have CASS piping in the RCS, the project team agrees that this item is not applicable. |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| BWR piping and fittings; steam generator components (Item Number 3.1.1-25) | Wall thinning due to flow-accelerated corrosion | Flow-accelerated corrosion | Flow-Accelerated Corrosion (B2.1.19) | Consistent with GALL Report for BWR piping and fittings in the Reactor Coolant System.<br><br>MNGP is a BWR and does not have a steam generator. |
| Reactor coolant pressure boundary (RCPB) valve closure bolting, manway and holding bolting, and closure bolting in high pressure and high temperature systems (Item Number 3.1.1-26) | Loss of material due to wear; loss of preload due to stress relaxation; crack initiation and growth due to cyclic loading and/or SCC | Bolting integrity | Bolting Integrity (B2.1.4) is used to manage loss of preload for stainless steel and carbon steel bolts and is used to manage loss of material due to general corrosion for carbon steel bolts. | Consistent with GALL Report, based upon applicant's clarification of the intention of the LRA's discussion for this item. (See Section 3.1.2.1.2) |
| Feedwater and control rod drive (CRD) return line nozzles (Item Number 3.1.1-27 | Crack initiation and growth due to cyclic loading | Feedwater nozzle; CRD return line nozzle | BWR Feedwater Nozzle Program (B2.1.8);<br><br>CRD Return Line Nozzle Program (B2.1.7) | Consistent with GALL Report for the feedwater nozzle.<br><br>Consistent with GALL Report for the CRD return line nozzle, with acceptable exceptions in AMP program elements. |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Vessel shell attachment welds(Item Number 3.1.1-28) | Crack initiation and growth due to SCC and/or IGSCC | BWR vessel ID attachment welds; water chemistry | BWR Vessel ID Attachment Welds Program (B2.1.11) Plant Chemistry Program (B2.1.25) | Consistent with GALL Report. |
| Nozzle safe ends, recirculation pump casing, connected systems piping and fittings, body and bonnet of valves (Item Number 3.1.1-29) | Crack initiation and growth due to SCC and/or IGSCC | BWR stress corrosion cracking; water chemistry | Plant Chemistry Program (B2.1.25); and BWR Stress Corrosion Cracking Program (B2.1.10), or ASME Section XI In-service Inspection, Subsection IWB, IWC, and IWD Program (B2.1.2), or One-Time Inspection (B2.1.23) | Consistent with GALL Report, with acceptable exceptions (See Section 3.1.2.1.3) |
| Penetrations (Item Number 3.1.1-30) | Crack initiation and growth due to SCC, IGSCC, and/or cyclic loading | BWR bottom head penetration; water chemistry | BWR Penetrations Program (B2.1.9), and Plant Chemistry Program (B2.1.25) | Consistent with GALL Report. |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Core shroud and core plate, support structure, top guide, core spray lines and spargers, jet pump assemblies, control rod drive housing, and nuclear instrumentation guide tubes (Item Number 3.1.1-31) | Crack initiation and growth due to SCC, IGSCC, and/or IASCC | BWR vessel internals; water chemistry | BWR Vessel Internals Program (B.2.12), and Plant Chemistry Program (B2.1.25) | Consistent with GALL Report. |
| Core shroud and core plate access hole cover (welded and mechanical covers) (Item Number 3.1.1-32) | Crack initiation and growth due to SCC, IGSCC, and/or IASCC | ASME section XI inservice inspection; water chemistry | ASME Section XI In-service Inspection, Subsection IWB, IWC, and IWD Program (B2.1.2), and Plant Chemistry Program (B2.1.25) | Consistent with GALL Report. |
| Jet pump assembly castings and orificed fuel support (Item Number 3.1.1-33) | Loss of fracture toughness due to thermal aging and nuclear irradiation enhancement | Thermal aging and neutron irradiation embrittlement | Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program (B2.1.33) | Consistent with GALL Report. |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Unclad top head and nozzles(Item Number 3.1.1-34) | Loss of material due to general, pitting, and crevice corrosion | Inservice inspection; water chemistry | Not applicable. The top head enclosure is clad at MNGP. | The LRA states that the top head is clad at MNGP. On the basis that MNGP does not have an unclad top head, the project team agrees that this item is not applicable. |
| 3.1.1-35 | PWR Only | | | |
| 3.1.1-36 | PWR Only | | | |
| 3.1.1-37 | PWR Only | | | |
| 3.1.1-38 | PWR Only | | | |
| 3.1.1-39 | PWR Only | | | |
| 3.1.1-40 | PWR Only | | | |
| 3.1.1-41 | PWR Only | | | |
| 3.1.1-42 | PWR Only | | | |
| 3.1.1-43 | PWR Only | | | |
| 3.1.1-44 | PWR Only | | | |
| 3.1.1-45 | PWR Only | | | |
| 3.1.1-46 | PWR Only | | | |
| 3.1.1-47 | PWR Only | | | |
| 3.1.1-48 | PWR Only | | | |

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

The following sections identify those line items where the project team found a difference between the GALL Report and the MNGP LRA.

3.1.2.1.1 Loss of Fracture Toughness due to Thermal Aging Embrittlement

In the discussion section of Table 3.1.1, Item Number 3.1.1-23 of the MNGP LRA, the applicant states that,

> This line item is not used at MNGP. The reactor coolant systems components of CASS material are portions of the Jet Pump, Fuel Support, and CRD assemblies. See item 3.1.1-31 and 3.1.1-33 for these components. In addition, CASS valve bodies in the ESF system are discussed in item 3.2.1-11 of Table 3.2.1.

During the audit and review, the project team noted that the discussion in the MNGP LRA states that “this line is not used at MNGP.” Based on the LRA discussion in Table 3.1.1, Item 3.1.1-23, the project team reviewed engineered safety feature Item Number 3.2.1-11 in LRA Table 3.2.1 for piping and fitting of CASS in the emergency core cooling system. The project team confirmed that the MNGP LRA included AMR results for valve bodies made of CASS in the Core Spray System (LRA Table 3.2.2-3) and in the Residual Heat Removal System (LRA Table 3.2.2-7) which the applicant had referenced appropriately to GALL line IV.C1.3-b. The project team also confirmed that the material, environment, aging effect and aging management program combination specified in the LRA for these valves is consistent with GALL line IV.C1.3-b, which applies for valves made of CASS in a reactor coolant water environment with an aging effect of loss of fracture toughness due to thermal aging embrittlement, and which specifies the ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD as the AMP for Class 1 components. However, the project team noted that the applicant had linked these AMR results lines with Item Number 3.1.1-23 in LRA Table 3.1.1 (quoted above) where the discussion states that, "This line item is not used at MNGP."

The project team asked the applicant to resolve the LRA discrepancy of linking AMR results lines for components in one table with an Item Number in another table where the discussion says that the Item Number is not used at MNGP. In response, as documented in applicant’s letter dated August 11, 2005 (ML052280269), the applicant states:

> LRA Table 3.1.1, Item Number 3.1.1-23, should be revised to read, “CASS components in the ESF systems subject to an environment that supports loss of fracture toughness due to thermal aging embrittlement were assigned to the ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD Program. Those CASS components that are subject to this aging effect/ mechanism are valves.”

The project team finds the applicant’s response acceptable on the basis that the components, material, aging effect and aging management program identified in the MNGP are consistent with the GALL Report. The project team finds that the applicant has appropriately addressed the aging management for these components. The project team’s review and evaluation of the applicant’s ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program is documented in Section 2.2 of this audit and review report.

On the basis of its review, the project team finds that the applicant addressed the aging effects/ mechanisms as identified in the GALL Report.

3.1.2.1.2 Loss of Material due to Wear; Loss of Preload due to Stress Relaxation; Crack Initiation and Growth due to Cyclic Loading and/or SCC

In the discussion section of Table 3.1.1, Item Number 3.1.1-26 of the MNGP LRA, the applicant states that:

> This line item is not used at MNGP. The aging mechanism of general corrosion is managed by the Bolting Integrity Program. There are no bolts with a specified minimum yield strength greater than 150 ksi in the reactor coolant system with the exception of the reactor head closure studs [which are in line item number 3.1.1-22]. Therefore, crack initiation and growth due to SCC is not an applicable aging effect. Reactor Vessel Internals (RIT) core plate bolts are subject to crack initiation and growth due to SCC, IGSCC, and/or IASCC; however, these bolts are not closure bolts. See item 3.1.1-31 [crack initiation and growth due to SCC, IGSCC, IASCC for Core Shroud and Core Plate, Support Structure, Top Guide, and various other Reactor Internal Components] for discussion on core plate bolts crack initiation and growth.
>
> Closure bolting preload is effectively addressed in the design (material selection, bolt and nut sizes), installation (torque, lubricant, bolting pattern), and maintenance requirements (retorquing, final checks). Operating temperature in MNGP systems are blow the threshold temperature where thermal creep of the bolting material could occur. MNGP plant operating experience shows no bolted closure failures due to loss of preload. While not specifically identified as an aging effect in the respective system Table 2, Summary of Aging Management Evaluation, loss of preload is managed for carbon steel and stainless steel closure bolting used in pressure retaining joints by the Bolting Integrity Program.
>
> The Bolting Integrity Program manages loss of preload associated with closure bolting through periodic inspection, material selection, thread lubricant control, assembly and torque requirements, and repair and replacement.

During the audit and review, the project team noted that the LRA's statement, "This line is not used at MNGP," appears to be in conflict with the discussion, because the discussion does, in fact, include information about reactor coolant pressure boundary valve closure bolting. The project team asked the applicant to clarify the intention of the LRA's statement that the line is not used at MNGP. The project team also asked the applicant to identify and provide a technical reference to support the LRA's statements that crack initiation and growth due to SCC is not applicable for bolts with yeild strength less than 150 ksi and to provide a technical reference to support the LRA's statement that operating temperatures at MNGP are below the threshold temperature where thermal creep of bolting material could occur.

In response, the applicant identified EPRI Technical Report TR-1003056, "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools," Revision 3, as the applicable reference for both LRA statements. In addition, the applicant stated that the statement, "This line is not used at MNGP," means that no line items in LRA Tables 3.1.2-1, -2, -3, -4 or -5 or in any other 3.x.2-y tables make reference to this Table 3.1.1 Item Number 3.1.1-26. However, the applicant further stated that information contained in the discussion column for this line item is applicable for bolting in the reactor coolant system.

The project team reviewed the applicant's technical reference and determined that the applicant has used an appropriate technical reference to support a conclusion that (1) crack initiation and growth due to SCC and (2) loss of preload due to thermal creep will not occur at MNGP. The project team noted that in LRA Tables 3.1.2-1, -4 and -5, for the reactor head vent system, the reactor recirculation system, and the reactor vessel instrumentation system, respectively, the component type “fasteners/bolting” is referenced to Table 3.2.1, Item Number 3.2.1-18, where the aging management program is also the Bolting Integrity Program (MNGP AMP B2.1.4). The project team also noted that Table 3.2.1, Item Number 3.2.1-18 includes a discussion similar to the one provided in Table 3.1.1, Item Number 3.1.1-26. Based on its determination that no line items in the 3.x.2-y tables reference Table 3.1.1, Item Number 3.1.1-26, and that the fasteners/bolting components in Tables 3.1.2-1, -4 and -5 do reference Table 3.2.1, Item Number 3.2.1-18 where the AMP is MNGP’s Bolting Integrity Program (B2.1.4), the project team concluded that the applicant’s explanations are satisfactory and that the aging effects applicable for closure bolting in the reactor coolant system will be appropriately managed during the period of extended operation.

Based on the reviews described above, the project team concluded that aging effects applicable for reactor coolant system bolting at MNGP are being managed appropriately by MNGP’s AMP B2.1.4, Bolting Integrity Program, and that LRA Table 3.1.1, Item Number 3.1.1-26 is, therefore, consistent with the GALL Report. Project team review of the Bolting Integrity Program is documented in Section 2.4 of this audit and review report.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging effects/mechanisms, as identified in the GALL Report.

3.1.2.1.3 Crack Initiation and Growth due to SCC and/or IGSCC

In the discussion section of Table 3.1.1, Item Number 3.1.1-29 of the MNGP LRA, the applicant states that:

> The aging effect is managed by the Plant Chemistry Program and the BWR Stress Corrosion Cracking Program; or the Plant Chemistry Program and the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program for reactor coolant boundary components not in the scope of the BWR Stress Corrosion Cracking Program.
>
> For components that do not fall within the scope of the BWR Stress Corrosion Cracking Program or are not subject to a volumetric examination per ASME Section XI, the Plant Chemistry Program and One-Time Inspection Program manage the aging effect for these components.

During the audit and review, the project team noted that the GALL Report identifies the aging management programs applicable for this aging effect as GALL AMP XI.M2, Water Chemistry, and GALL AMP XI.M7, BWR Stress Corrosion Cracking; however, the MNGP LRA’s discussion identified MNGP’s AMP B2.1.25, Plant Chemistry, together with either MNGP’s AMP B2.1.10, BWR Stress Corrosion Cracking; or MNGP’s AMP B2.1.2, ASME Section XI Inservice Inspection, Subsections IWB, IWC, or IWD; or MNGP’s AMP B2.1.23, One-Time Inspection. The project team also noted that in the MNGP LRA the only plant systems referencing to Table 3.1.1, Item Number 3.1.1-29, are the reactor pressure vessel, the reactor recirculation system, and the reactor vessel instrumentation system, plus flow elements in the main steam system.

Based on the list of BWR plant systems in the GALL Report, Volume 2, Item IV.C1.1-f, the project team had anticipated that stainless steel, Class 1 piping in several of MNGP's engineered safety features systems would reference Table 3.1.1, Item Number 3.1.1-29.

The project team asked the applicant to explain (1) why the LRA appeared to identify aging management programs in addition to the ones listed in the GALL Report for this component-material-environment-aging effect combination and (2) to justify that all applicable Class 1 piping is appropriately included in the MNGP aging management programs.

In response, the applicant states that except for piping in the reactor recirculation system and in the reactor vessel instrumentation system, most of the Class 1 piping connected to the reactor vessel is made of carbon steel, not stainless steel, and is not subject to the aging effect/mechanism of crack initiation and growth due to SCC. The applicant further states that in MNGP LRA Tables 3.2.2-3 and 3.2.2-7 for the core spray and the residual heat removal (RHR) systems, respectively, the stainless steel piping and fittings shown in a treated water environment are instrument tubing and/or small 1" piping that leads to instrument tubing. The applicant states that because of stagnant flow in the instrument lines, these components are not exposed to temperatures greater than 140 deg-F; that, based on Appendix A of EPRI TR-1003056, Non-Class 1 Mechanical Implementation Guidelines and Mechanical Tools," Revision 3, SCC rarely occurs in austenitic stainless steel below 140 deg-F; and that cracking due to SCC is not an aging effect applicable for these components. The applicant states that the remaining core spray and RHR Class 1, reactor coolant pressure boundary piping and fittings are constructed of carbon steel. The applicant states that Class 1 carbon steel piping is included in the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program but not in the BWR Stress Corrosion Cracking Program.

The applicant also states that the stainless steel nozzles for reactor vessel instrument lines and for the instrument/standby liquid control line are less than 4" in diameter and that the attached stainless steel piping is not included in the BWR Stress Corrosion Cracking Program because the "Scope of Program" element in GALL AMP XI.M7 states that the program is applicable to piping made of austenitic stainless steel that is 4-inches or larger in nominal diameter. The applicant states that for these components MNGP uses the ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Program and that generic note E is assigned to the line items for these components to indicate that the line is "consistent with NUREG-1801 for material, environment and aging effect, but a different aging management program is credited."

The project team reviewed the applicant's piping diagrams for the reactor coolant system and connected systems that use color coding to indicate the ASME classification of pipe segments together with the applicant's piping specifications which identify material of construction for each pipe segment shown on the diagrams . The project team confirmed by this review that, except for the stainless steel reactor recirculation system piping, all large-bore Class 1 piping connected to the MNGP reactor vessel is manufactured of carbon steel, not stainless steel. Based on the facts that (1) carbon steel is not subject to the aging effect/mechanism of crack initiation and growth due to SCC/IGSCC and (2) except for the recirculation system, all large bore piping connected to the reactor vessel is carbon steel, the project team concluded that (1) the applicant has correctly assigned all applicable reactor coolant system components to the BWR Stress Corrosion Cracking Program, and (2) that, consistent with the GALL Report, the applicant will be managing the aging effect/mechanism of crack initiation and growth due to SCC/IGSCC with the BWR Stress Corrosion Cracking Program (MNGP AMP B2.1.10) and the Plant Chemistry Program (MNGP AMP B2.1.25) and that small bore piping included in these programs is also included in the One-Time Inspection Program (MNGP AMP B2.1.23). Project team reviews of the BWR Stress Corrosion Cracking Program, the Plant Chemistry Program, and the One-Time Inspection Program are documented in Sections 2.10, 2.25, and 2.23, respectively, of this audit and review report.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging effects/mechanisms as identified in 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 claimed 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 functions will be maintained for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2 Aging Management Review Results for Which Further Evaluation Is Recommended by the GALL Report

For some line items assigned to the project team in the MNGP LRA Tables 3.1.2-1 through 3.1.2-5 (Table 2s), the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provide in MNGP LRA Section 3.1.2.2 against the criteria provided in the SRP-LR Section 3.1.2.2. The project team's assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 line-item in Section 3.1 citing the item in Table 3.1.1.

3.1.2.2.1 Cumulative Fatigue Damage

Cumulative fatigue is a TLAA, as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The evaluation of this TLAA is performed by NRR DE staff and addressed in Section 4 of the SER related to the MNGP LRA.

3.1.2.2.2 Loss of Material Due to Crevice and Pitting Corrosion

3.1.2.2.2.1 Steam Generator Shell

In LRA Section 3.1.2.2.2.1 the applicant states that loss of material for a steam generator shell assembly is applicable to PWRs only.

On the basis that MNGP does not have any components from this group, the project team concurs with the applicant's determination that this aging effect is not applicable to MNGP; therefore, the project team did not review this item.

3.1.2.2.2.2 Isolation Condenser

In MNGP LRA Section 3.1.2.2.2.2 the applicant states that loss of material for a BWR isolation condenser is not applicable to MNGP because MNGP does not have an isolation condenser.

On the basis that MNGP does not have any components from this group, the project team concurs with the applicant's determination that this aging effect is not applicable to MNGP.

3.1.2.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement

3.1.2.2.3.1 Pressure Vessel Ferritic Materials that Have a Neutron Fluence Greater than $10^{17}$ $n/cm^2$ ,TLAA

Neutron irradiation embrittlement is a TLAA, as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10CFR 54.21(c)(1). The evaluation of this TLAA is performed by NRR DE staff and addressed in Section 4 of the SER related to the MNGP LRA. Therefore, the project team did not review this item.

3.1.2.2.3.2 Reactor Vessel Embrittlement

In MNGP LRA Section 3.1.2.2.3.2 the applicant states that loss of fracture toughness due to neutron irradiation embrittlement could occur in the reactor vessel. A materials surveillance program monitors neutron irradiation embrittlement of the reactor vessel. The MNGP reactor vessel surveillance program, and the results of its evaluation for license renewal, are presented in MNGP LRA Appendix B.

Reactor vessel embrittlement is reviewed by NRR DE staff and addressed in Appendix B of the SER related to the MNGP LRA.

3.1.2.2.4 Crack Initiation and Growth Due to Thermal and Mechanical Loading or Stress Corrosion Cracking

3.1.2.2.4.1 Small-Bore Reactor Coolant System and Connected System Piping

The project team reviewed MNGP LRA Section 3.1.2.2.4.1 against the criteria in SRP-LR Section 3.1.2.2.4.1, which states:

> Crack initiation and growth due to thermal and mechanical loading or SCC (including intergranular stress corrosion cracking [IGSCC]) could occur in small-bore reactor coolant system and connected system piping less than NPS 4. The existing program relies on ASME Section XI ISI and on control of water chemistry to mitigate SCC. The GALL report recommends that a plant-specific destructive examination or a nondestructive examination (NDE) that permits inspection of the inside surfaces of the piping be conducted to ensure that cracking has not occurred, and the component intended function will be maintained during the extended period. The AMPs should be augmented by verifying that service-induced weld cracking is not occurring in the small-bore piping less than NPS 4, including pipe, fittings, and branch connections. A one-time inspection of a sample of locations is an acceptable method to ensure that the aging effect is not occurring and the component's intended function will be maintained during the period of extended operation.

In MNGP LRA Section 3.1.2.2.4.1, the applicant states that this aging effect [crack initiation and growth] is managed by MNGP AMP B2.1.2, ASME XI In-Service Inspection, Subsections IWB, IWC, and IWD, together with MNGP AMP B2.1.25, Plant Chemistry, and MNGP AMP B2.1.23, One-Time Inspection. The applicant further states that ASME Section XI does not require the volumetric examination of pipes less than 4-inch nominal pipe size and that the scope of the One-Time Inspection includes activities to validate the effectiveness of existing aging management program by verifying that unacceptable degradation is not occurring. The applicant states that the aging effect that is monitored/inspected by the MNGP's One-Time Inspection includes crack initiation and growth and that this program includes one-time inspections to monitor a component's degradation using a variety of non-destructive examination methods.

Based on review of MNGP's LRA Section 3.1.2.2.4.1, review of Tables 3.1.2-1 through 3.1.2-5, and review of LRA Appendix B2.1.23, the project team confirmed that small bore, Class 1 piping in the head vent system and the reactor vessel instrumentation system are appropriately included in the applicant's One-Time Inspection Program.

Based on its review of the applicant's drawings of the reactor coolant system and connected systems, the project team identified a number of small-bore Class 1 pipe segments and asked the applicant whether each of the segments is included in MNGP's One-Time Inspection Program. In its response, as documented in its letter of August 11, 2005 (ML052280269), the applicant provided sufficient information, including references to MNGP LRA table entries, for the project team to conclude that all Class 1 small bore pipe segments are appropriately included in the applicant's One-Time Inspection Program.

As part of its response, the applicant states that in Class 1, small bore stainless steel piping, the aging effect being managed by Plant Chemistry and One-Time Inspection is cracking due to stress corrosion cracking; however, in Class 1 small bore carbon steel piping, the aging effect being managed by Plant Chemistry and One-Time Inspection in loss of material due to corrosion. Because different examination techniques typically are required to detect the aging effect of cracking versus the aging effect of loss of material, the project team asked the applicant to justify why the Class 1, small bore carbon steel piping was not being managed for an aging effect of crack initiation and growth due to thermal and mechanical loading.

In its letter dated August 11, 2005 (ML052280269), the applicant states that it has performed an analytical evaluation to classify all Class 1 and 2 piping welds by failure potential. The evaluation is based on methodology in EPRI Topical Report TR-112657, "Revised Risk-Informed Inservice Inspection Evaluation Procedure," Rev. B-A (ML013470120). Based on this evaluation, the applicant has determined that it has no Class 1, small-bore carbon steel piping in an environment where cracking due to mechanical or thermal loading will occur. Consequently, one-time inspection of Class 1, small bore carbon steel piping will focus on the loss of material aging effect, but not on the crack initiation and growth aging effect.

The project team reviewed the applicant's response, as documented in its letter of August 11, 2005 (ML052280269), together with the applicant's calculation NMC-01-301, "Degradation Mechanism Evaluation for Class 1 and 2 Piping Welds at Monticello Nuclear Generating Plant," which provides the analytical basis for excluding cracking as an aging effect in Class 1, small bore carbon steel piping at MNGP. The project team notes that in the Standard Review Plan for License Renewal Applications, Section 3.1.2.2.4, there is no distinction drawn between stainless steel and carbon steel piping, and that the purpose of the one-time inspection is to validate the absence of cracks that might not be detected by the ASME Section XI examinations required for small bore piping. On the basis that the applicant will perform a One-Time Inspection for cracking in stainless steel small bore piping, and that the applicant has used an appropriate methodology to exclude the aging effect of cracking in carbon steel small bore piping, the project team concludes that the applicant's programs for managing aging effects in Class 1, small bore piping are acceptable. Project team reviews and evaluations of the applicant's ASME Section XI, Subsections IWB, IWC, and IWD Program, the Plant Chemistry Program, and the One-Time Inspection Program are documented in Sections 2.2, 2.25, and 2.23, respectively, of this audit and review report.

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. For those line items that apply to MNGP LRA Section 3.1.2.2.4.1, the project team finds that the applicant is consistent with the GALL Report and has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation as required by 10 CFR 54.21 (a)(3).

3.1.2.2.4.2 Reactor Vessel Flange Leak Detection Line and Jet Pump Sensing Line

The project team reviewed MNGP LRA Section 3.1.2.2.4.2 against the criteria in SRP-LR Section 3.1.2.2.4.2, which states:

> Crack initiation and growth due to thermal and mechanical loading or SCC (including IGSCC) could occur in BWR reactor vessel flange leak detection lines and BWR jet pump sensing lines. The GALL report recommends that a plant specific aging management program be evaluated to mitigate or detect crack initiation and growth due to SCC of vessel flange leak detection lines and BWR jet pump sensing lines.

In MNGP LRA Section 3.1.2.2.4.2, the applicant states that the Jet Pump Sensing Lines internal to the Reactor Vessel are not in the scope of license renewal at MNGP, and the applicant refers to the LRA's "Further Evaluation" description of "Crack Initiation and Growth due to Thermal and Mechanical Loading or Stress Corrosion Cracking" regarding management of the Reactor Vessel Flange Leak Detection Line and other small-bore reactor coolant system and connected system piping.

The project team notes that the Jet Pump Sensing Lines external to the vessel are small-bore piping and are included in LRA Table 3.1.2-5 as piping and fittings made of stainless steel in an environment of treated water, with an aging effect of cracking due to SCC/IGA. For this component, material, environment and aging effect, the MNGP LRA states that the applicable aging management programs are the ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD Program, the One-Time Inspection Program, and the Plant Chemistry Program; this is consistent with the GALL Report recommendation for small bore, stainless steel pipe in a reactor coolant water environment. Based on consistency with the GALL Report recommendations, the project team finds the applicant's aging management programs for these components acceptable.

For aging management of the Reactor Vessel Flange Leak Detection Line, the applicant, in MNGP LRA Section 3.1.2.2.4.2, states that the aging effects/mechanisms for this component is the same as for other small-bore reactor coolant system and connected system piping. For these components, the applicable aging management programs are the ASME Section XI In-Service Inspection, Subsections IWB, IWC and IWD Program together with the Plant Chemistry Program and the One-Time Inspection Program. Since the Reactor Vessel Flange

Leak Detection Line has the same material and environment, and consequently the same aging effects as other Class 1 small bore piping, the project team concludes that the aging management programs that the applicant has identified for this component are acceptable. Project team reviews and evaluations of the applicant's ASME Section XI, Subsections IWB, IWC, and IWD Program, the Plant Chemistry Program, and the One-Time Inspection Program are documented in Sections 2.2, 2.25, and 2.23, respectively, of this audit and review report.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.4.2 for further evaluation. For those line items that apply to MNGP LRA Section 3.1.2.2.4.2, the project team finds that the applicant is consistent with the GALL Report and has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation as required by 10 CFR 54.21 (a)(3).

3.1.2.2.4.3 Isolation Condenser Components

In LRA Section 3.1.2.2.4.3, the applicant states that crack initiation and growth due to SCC or cyclic loading for a BWR isolation condenser is not applicable since MNGP does not have an isolation condenser.

On the basis that MNGP does not have any components from this group, the project team concurs with the applicant's determination that this aging effect is not applicable to MNGP; therefore, the project team did not review this item.

Conclusion. On the basis of its audit for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the project team determines that (1) those attributes or features for which the applicant claimed consistency with the GALL Report were indeed consistent and (2) the applicant adequately addressed the issues that were further evaluated. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.1.2.3 AMR Results That Are Not Consistent with the GALL Report or Not Addressed in the GALL Report

In MNGP LRA Tables 3.1.2-1 through 3.1.2-5, 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.

#### 3.1.2.3.1 Aging Management Review Results Where No Aging Effects Were Identified (MNGP LRA Tables 3.1.2-1 through 3.1.2-5)

In MNGP LRA Tables 3.1.2-1 through 3.1.2-5 the applicant identified AMR results line-items where no aging effects were identified as a result of the aging review process. Specifically, the applicant states that no aging effects occurred when components fabricated from stainless steel material were exposed to a primary containment air or plant indoor air environment, or when components fabricated from stainless steel or carbon steel were exposed to a lubricating oil internal environment. The applicant states that a material science evaluation for these materials in these environments results in no aging effects.

Based on the fact that stainless steels are highly resistant to corrosion in dry atmospheres in the absence of corrosive species, as cited in Metals Handbook, Ninth Edition, American Society for Metals International, the staff has accepted the position that stainless steel in an indoor, uncontrolled air environment (e.g., plant indoor air) or in a gas environment (e.g., primary containment air inerted with nitrogen) exhibits no aging effect and that the component or structure will therefore remain capable of performing its intended functions consistent with the current licensing basis for the period of extended operation. Based on the fact that both oxygen and moisture must be present to corrode steel, as cited in Metals Handbook, Ninth Edition, American Society for Metals International, the staff has also accepted the position that steel [carbon or stainless] in a lubricating oil internal environment with no water pooling exhibits no aging effect and that the component or structure will therefore remain capable of performing its intended functions consistent with the current licensing basis for the period of extended operation.

On the basis of its review of current industry research and operating experience, the project team finds that plant indoor air or primary containment air on stainless steel, or lubricating oil on stainless steel or carbon steel, will not result in aging that will be of concern during the period of extended operation. Therefore, the project team concludes that there are no applicable aging effects requiring management for the component material and environment described in the preceding discussion.

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

#### 3.1.2.3.2 Reactor Coolant System - Reactor Pressure Vessel – Summary of Aging Management Evaluation – (MNGP LRA Table 3.1.2-2)

The project team reviewed MNGP LRA Table 3.1.2-2, which summarizes the results of AMR evaluations for the Reactor Pressure Vessel component group.

In MNGP LRA Table 3.1.2-2, the applicant states that the aging effect of cumulative fatigue damage due to fatigue of Type 316NG stainless steel materials for the component type of nozzle safe end/control rod drive return line cap exposed to a reactor coolant water environment is not applicable, and no aging management program is specified. The MNGP LRA assigns note I to this item, indicating that the aging effect in the GALL Report for this component, material and environment combination is not applicable. An additional note in the MNGP LRA states that the CRD hydraulic return nozzle was capped with a 4" diameter pipe cap in 1977, that the CRD return nozzle weld butter was removed and the weld preparation was reclad with CrC (chromium carbide) to improve resistance to intergranular stress corrosion cracking (IGSCC), and that a new nozzle cap was installed in 1986. The MNGP LRA Table 3.1.2-2 also states that the aging effect of crack initiation and growth due to SCC or IGSCC is also applicable for this component, and that the aging effect is managed by the BWR Stress Corrosion Cracking Program (MNGP AMP B2.1.10) and the Plant Chemistry Program (MGNP AMP B2.1.25).

The project team noted that in its evaluation of this component the applicant refers to GALL Report, Volume 2, Item IV.A1.4-b, which is the control rod drive return line nozzle safe end. The GALL Report line item is based on an inservice control rod drive return line safe end that would routinely experience cyclic flow, not one that has effectively been taken out of service by removing the previously attached pipe and installing a cap on the safe end. Capping the control rod drive return line safe end eliminated the cyclic flow environment to which the safe end was previously exposed and thereby eliminated the potential for the aging effect of cumulative fatigue damage. In addition, review of MNGP operating experience since the CRD return line nozzle cap replacement in 1986 indicates that no new cracking has occurred at this location. Based on the fact that there is no potential for cumulative fatigue damage created by flow cycling at the capped control rod drive return line safe end and that no new cracking has been detected at this location since the nozzle was capped, the project team finds the applicant's statement that cumulative fatigue damage is not applicable for the control rod drive return line safe end cap in the Reactor Coolant System - Reactor Pressure Vessel to be acceptable.

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

#### 3.1.2.3.3 Reactor Coolant System - Reactor Pressure Vessel Internals – Summary of Aging Management Evaluation – (MNGP LRA Table 3.1.2-3)

The project team reviewed MNGP LRA Table 3.1.2-3, which summarizes the results of AMR evaluations for the Reactor Pressure Vessel Internals component group.

In MNGP LRA Table 3.1.2-3, the applicant proposes to manage crack initiation and growth due to cyclic loading of stainless steel materials for component types of steam dryer exposed to reactor coolant water or steam environment using MNGP AMP B2.1.12, "BWR Vessel Internals."

The project team reviewed MNGP's BWR Vessel Internals Program and its evaluation is documented in Section 2.12 of this audit and review report. MNGP's BWR Vessel Internals Program provides for condition monitoring of the BWR vessel internals for crack initiation and growth. The program includes the in-vessel examination procedures and the plant water chemistry procedures. The in-vessel examination procedures implement the recommendations of the BWRVIP guidelines as well as the requirements of Section XI of the ASME Boiler and Pressure Vessel Code. As a result of steam dryer failure at Quad Cities following an extended power uprate, steam dryers have been determined to be in scope of license renewal for category (a)(2). They may exhibit cracking due to flow-induced vibration or cyclic loading and therefore require management by a program.

MNGP LRA Table 3.1.2-3 identifies MNGP AMP B2.1.12, BWR Vessel Internals, as the applicable program to manage the aging effect/mechanism of crack initiation and growth due to cyclic loading. The applicant, in note 136 of the MNGP LRA, states that the inspection of the steam dryer is to be accomplished using the guidelines in the approved BWRVIP topical report for the steam dryer inspection and that in the event a new steam dryer is installed, inspection requirements for the steam dryer will be reevaluated. On the basis that MNGP will perform steam dryer inspections consistent with approved, industry-consensus inspection guidelines, the project team concludes that MNGP's proposed aging management program is acceptable.

On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effect of crack initiation and growth due to cyclic loading of stainless steel material in the steam dryer exposed to reactor coolant water or steam environment at uprated power conditions are effectively managed using the BWR Vessel Internals program. On this basis, the project team finds that management of crack initiation and growth due to cyclic loading in the Reactor Coolant System - Reactor Pressure Vessel Internals is acceptable.

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

### 3.1.3 Conclusion

On the basis of its review, the project team concludes that the applicant has demonstrated that the aging effects associated with the reactor vessel, internals, and reactor coolant system components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3).

The project team also reviewed the applicable USAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the reactor vessel, internals, and reactor coolant system, as required by 10 CFR 54.21(d).

## 3.2 MNGP LRA Section 3.2 - Aging Management of Engineered Safety Features

### 3.2.1 Summary of Technical Information in the LRA

In Section 3.2 of the LRA, the applicant provided the results of its AMRs for the engineered safety features. In Tables 3.2.2-1 through 3.2.2-8, the applicant provided a summary of the AMRs for components/commodities in the (1) automatic pressure relief system (APR), (2) combustion gas control system (CGS), (3) core spray system (CSP), (4) high-pressure coolant injection system (HPCI), (5) primary containment mechanical system (PCM), (6) reactor core isolation cooling system (RCIC), (7) residual heat removal system (RHR), and (8) secondary containment system (SCT). The summary information for each component type included intended function; material; environment; aging effect requiring management; AMPs; the GALL Report Volume 2 item; cross reference to the LRA Table 3.2.1 (Table 1); and generic and plant-specific notes related to consistency with the GALL Report.

Also the applicant identified for each component type in the LRA Table 3.2.1 those components that are consistent with the GALL Report, those that are consistent with the GALL Report in which further evaluation is recommended, and those that are not addressed in the GALL Report together with the basis of their exclusion.

### 3.2.2 Project Team Evaluation

The project team conducted its audit and review in accordance with SRP-LR Section 3.2.3 and the MNGP audit plan. The project team interviewed the applicant's technical project team and reviewed, in whole or in part, the documents listed in Attachment 5 of this audit and review report.

Table 3.2-1 presents the project team evaluation for engineered safety feature components in the GALL Report.

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

For AMRs that the applicant states are consistent with the GALL Report, the project team conducted its audit and review to determine if the applicant's references to the GALL Report in the MNGP LRA are acceptable.

**Table 3.2-1 Project Team Evaluation for Engineered Safety Feature Components in the GALL Report**

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Piping, fittings, and valves in emergency core cooling system (Item Number 3.2.1-01) | Cumulative fatigue damage | TLAA, evaluated in accordance with 10 CFR 54.21© | TLAA | This TLAA is evaluated in Section 4.3, Metal Fatigue (See Section 3.2.2.2.1) |
| Piping, fittings, pumps, and valves in emergency core cooling system (Item Number 3.2.1-02) | Loss of material due to general corrosion. | Water chemistry and One-time inspection | Plant chemistry program (B21.25); One-time inspection (B2.1.23) | Consistent with GALL Report, which recommends further evaluation (See Section 3.2.2.2.2.1) |
| Components in containment spray (PWR only), standby gas treatment (BWR only), containment isolation, and emergency core cooling system (Item Number 3.2.1-03) | Loss of material due to general corrosion | Plant specific | One-time inspection (B2.1.23); System condition monitoring program (B2.1.32) | Consistent with GALL Report, which recommends further evaluation (See Section 3.2.2.2.2.2) |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Piping, fittings, pumps, and valves in emergency core cooling system (Item Number 3.2.1-04) | Loss of material due to pitting and crevice corrosion | Water chemistry and one-time inspection | Plant chemistry program (B21.25); One-time inspection (B2.1.23) | Consistent with GALL Report, which recommends further evaluation (See Section 3.2.2.2.3.1) |
| Components in containment spray (PWR only), standby gas treatment (BWR only), and emergency core cooling systems (Item Number 3.2.1-05) | Loss of material due to pitting and crevice corrosion | Plant specific | Plant chemistry program (B21.25); One-time inspection (B2.1.23) | Consistent with GALL Report, which recommends further evaluation (See Section 3.2.2.2.3.2) |
| Containment isolation valves and associated piping (Item Number 3.2.1-06) | Loss of material due to micro-biologically influenced corrosion (MIC) | Plant specific | Plant chemistry program (B21.25); One-time inspection (B2.1.23) | Consistent with GALL Report, which recommends further evaluation.<br><br>Note: This line item is not used at MNGP. (See Section 3.2.2.2.4) |
| Seals in standby gas treatment system (Item Number 3.2.1-07) | Changes in properties due to elastomer degradation | Plant specific | One-time inspection (B2.1.23); System condition monitoring program (B2.1.32) | Consistent with GALL Report, which recommends further evaluation (See Section 3.2.2.2.5) |
| 3.2.1-08 | PWR Only | | | |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Drywell and suppression chamber spray system nozzles and flow orifices (Item Number 3.2.1-09) | Plugging of flow orifice and spray nozzles by general corrosion products | Plant specific | Not applicable | Further evaluation (See Section 3.2.2.2.7) |
| External surface of carbon steel components (Item Number 3.2.1-10) | Loss of material due to general corrosion | Plant specific | System condition monitoring program (B2.1.32); One-time inspection (B2.1.23) | This line item is not in the SRP.<br><br>Components of this line item are in GALL Report. (See Section 3.2.2.3.2) |
| Piping and fittings of CASS in emergency core cooling systems (Item Number 3.2.1-11) | Loss of fracture toughness due to thermal aging embrittlement | Thermal aging embrittlement of CASS | Not Applicable. No CASS components susceptible to thermal aging embrittlement in engineered safety features. | Evaluation of the MNGP LRA that no CASS components are subject to this aging effect in the ESF, the project team concurs that this line item is not applicable. |
| Components serviced by open-cycle cooling system (Item Number 3.2.1-12) | Loss of material due to general pitting, and crevice corrosion, MIC, and biofouling; buildup of deposit due to biofouling | Open-cycle cooling water system | Open-cycle cooling water system program (B2.1.24); Plant chemistry program (B21.25); One-time inspection (B2.1.23) | Consistent with GALL Report (See Section 3.2.2.1) |
| Components serviced by closed-cycle cooling system (Item Number 3.2.1-13) | Loss of material due to general pitting, and crevice corrosion | Closed-cycle cooling water system | Closed-cycle cooling water system program (B2.1.13) | Consistent with GALL Report (See Section 3.2.2.1) |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Emergency core cooling system valves and lines to and from high-pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) pump turbines (Item Number 3.2.1-14) | Wall thinning due to flow-accelerated corrosion | Flow-accelerated corrosion | Flow accelerated corrosion (B2.1.19) | This line item is not used at MNGP<br><br>Consistent with GALL Report (See Section 3.2.2.1) |
| 3.2.1-15 | PWR Only | | | |
| Pumps, valves, piping and fittings in emergency core cooling system (Item Number 3.2.1-16) | Cracking initiation and growth due to SCC and IGSCC | Water chemistry and BWR stress corrosion cracking | Plant chemistry program (B2.1.25); BWR stress corrosion cracking (B2.1.10), or Plant Chemistry program and One-Time Inspection. | Consistent with GALL Report (See Section 3.2.2.1) |
| 3.2.1-17 | PWR Only | | | |
| Closure bolting in high-pressure or high-temperature systems (Item Number 3.2.1-18) | Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC | Bolting integrity | Bolting integrity (B2.1.4) | Consistent with GALL Report (See Section 3.2.2.1) |

In the MNGP LRA Section 3.2, the applicant provided the results of its AMRs for the engineered safety features systems.

In the MNGP LRA Tables 3.2.2-1 through 3.2.2-8, the applicant provided a summary of the AMRs  for components/commodities in the (1) automatic pressure relief system (APR); (2) combustible gas control system (CGS); (3) core spray system (CSP); (4) high pressure coolant injection system (HPCI); (5) primary containment mechanical system (PCM); (6) reactor core isolation cooling system (RCIC); (7) residual heat removal system (RHR); and (8); secondary containment system (SCT).

The summary information for each component type included intended function; material; environment; aging effect requiring management; AMPs; the GALL Report Volume 2 item; cross reference to the MNGP LRA Table 3.2.1 (Table 1); and generic and plant-specific notes related to consistency with the GALL Report.

The project team reviewed its assigned MNGP 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 components that are subject to an AMR.

The following sections identify those line items where the project team found a difference between the GALL Report and the MNGP LRA.

3.2.2.1.1 Loss of Fracture Toughness due to Thermal Aging Embrittlement of CASS

In the discussion section of Table 3.2.1, Item Number 3.2.1-11, of the MNGP LRA, the applicant states that:

> Not applicable. CASS components in the ESF systems subject to an environment that supports loss of fracture toughness due to thermal aging embrittlement were assigned the ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Program. Those CASS components that are subject to this effect/mechanism are valves. This component type screens out from being subject to the thermal aging embrittlement of CASS AMP per NUREG-1801, Vol. 2, Appendix B, Section XI.M12.

During the audit and review, the project team noted the discussion in the MNGP LRA states that "this line is not used at MNGP." The project team reviewed the MNGP Table 3.2.1, Item Number 3.2.1-11 for piping and fittings of CASS components subject to an environment that supports loss of fracture toughness due to thermal aging embrittlement in the emergency core cooling system. The project team confirmed that the MNGP LRA included AMR results for valve bodies made of CASS in the Core Spray System (MNGP LRA Table 3.2.2-3) and in the Residual Heat Removal System (MNGP LRA Table 3.2.2-7) which the applicant had referenced appropriately to GALL line IV.C1.3-b. The project team also confirmed that the material, environment, aging effect and aging management program combination specified in the MNGP LRA for these valves is consistent with GALL line IV.C1.3-b, which applies for valves made of CASS in a reactor coolant water environment with an aging effect of loss of fracture toughness due to thermal aging embrittlement, and which specifies the ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD as the AMP for Class 1 components. However, the project team interviewed the MNGP technical staff if other CASS components do or do not experience this aging effect. The applicant states that the only CASS components subject to reduction of fracture toughness are the Core Spray System valves (AO-14-13A,B, "11, 12 CS Testable Check Valves," (shown on drawing LR-36248) and RHR System valves; AO-10-46A,B "RHR DIV 1, 2LPSI Testable Check valve," (shown on drawing LR-36247). The project team reviewed these drawings and technical references related to these components and others in this system and concluded that the applicant appropriately addressed this issue.

On the basis that the components, material, aging effect/mechanism and aging management program identified in the MNGP LRA are consistent with the GALL Report, the project team concludes that the applicant has appropriately addressed the aging management for these components. The project team reviewed the applicant's ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Program and finds that this program is acceptable for managing aging loss of fracture toughness due to thermal aging embrittlement for ESF valves. The project team's evaluation of the applicant's ASME Section XI Inservice Inspection, Subsection IWB, IWC, and IWD Program is documented in Section 2.2 of this audit and review report.

On the basis of its review, the project team finds that the applicant addressed the aging effect/mechanism as identified in the GALL Report.

3.2.2.1.2 <u>Loss of Material due to Corrosion and/or Buildup of Deposit due to Biofouling</u>

In the discussion section of MNGP LRA Table 3.2.1, Number Item 3.2.1-12, the applicant states that:

> Aging effects are managed by the Open-Cycle Cooling Water System program, One-Time Inspection program, and Plant Chemistry program. Exceptions apply to the NUREG-1801 recommendation for Plant Chemistry program implementation (refer to Section B2.1.25) For those ESF heat exchangers that have a raw water environment, consistent with NUREG-1801, the Open-Cycle Cooling Water System program is credited. For heat exchangers that have a treated water environment, the One-Time Inspection Program and Plant Chemistry program are credited.

The applicant credits MNGP AMP B2.1.24, the Open-Cycle Cooling Water System, for managing aging of the heat exchangers in the ESF system that are made of copper alloy, stainless steel in a treated water/raw water, steam, and lubricating oil environment that are subject to loss of material due to corrosion and/or buildup of deposit due to biofouling. The Plant Chemistry (LRA Appendix B2.1.25) and One-Time Inspection program (LRA Appendix B.2.1.23) are also credited with managing these aging effects. The applicant uses the Open-Cycle Water System program for managing aging of the raw water side of the heat exchangers and for heat exchangers with treated water, the One-Time Plant Inspection program and Plant Chemistry program are credited (V.A.6-a/b, V.D1.6-1.-b/c, V.D2.4-a/b). These aging management programs—Open-Cycle Cooling Water System, the Plant Chemistry, and One-Time Inspection programs—were reviewed by the project team and found acceptable for corrosion and/or buildup of deposit due to biofouling on the ESF heat exchangers. The evaluation of the One-Time Inspection program, Open-Cycle Cooling Water System program, and Plant Chemistry program is documented in Sections 2.23, 2.24, and 2.25 of this audit review and report, respectively.

However, the applicant also credits these programs for managing the aging of, galvanic corrosion and SCC/IGA, which are not credited in the GALL Report. The project team interviewed the applicant as to why they considered this aging mechanisms. The project team concludes that the applicant is taking a conservative approach adding these aging mechanisms, which still results in the same aging effect, loss of material.

The MNGP LRA Sections in 3.2 address components serviced by the Open-Cycle Water System, which are supplemented by the Plant Chemistry and One-Time Inspection programs, which have notes that are not consistent with the GALL Report. The applicant also included aging mechanisms not listed in the GALL Report (pitting, crevice and MIC). These are considered loss of material as an aging effect, and thus, the applicant has taken a more conservative approach relative to the GALL Report.

Based on the review of the program above, the project team concludes that aging effects for loss of material and/or buildup of deposit due to biofouling for ESF components serviced by ECCS at MNGP are being managed appropriately by MNGP AMP B2.1.24, B2.1.23, B2.1.25; Open-Cycle Cooling Water Systems program; One-Time Inspection program and Plant Chemistry program; and that LRA Table 3.2.1, Item Number 3.2.1-12 is therefore consistent with the GALL Report.

On the basis of its review, the project team finds that the applicant addressed the aging effect/mechanisms as identified in the GALL Report.

3.2.2.1.3 Wall Thinning due to Flow-Accelerated Corrosion (FAC)

In the discussion section of MNGP LRA Table 3.2.1, Item Number 3.2.1-14, the applicant states that:

> Aging effect is managed by the Flow-Accelerated Corrosion Program. Consistent with NUREG-1801, some sections of the High Pressure Coolant Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) systems are susceptible to flow-accelerated corrosion (FAC) and the Flow-Accelerated Corrosion Program is credited to manage the aging effect. The predominate sections of the HPCI and RCIC systems were evaluated as not susceptible to FAC based on material type or the components have no flow or operate less than 2% of the plant operating time. The components that fall in the latter category do not require aging management for FAC in accordance with EPRI, NSAC-2021, R2 and NUREG-1557, “Summary of Technical Information and Agreements from the Nuclear Regulatory Management and Resources Council Industry Reports Addressing License Renewal.”

During the audit and review, the project team noted that Table 3.2.1, Item Number 3.2.1-14 was not used for Table 2 data. The project team reviewed the GALL Report (V.D2.1-f, V.D2.3-a), which does not contain a line item that covers ECCS piping in treated water susceptible to FAC. The applicant did not use Table 3.2.1, Item Number 3.2.1-14; instead, the applicant put ECCS piping and fittings, exposed to treated water and susceptible to FAC, in Table 3.1.1, Item Number 3.1.1-25 in the MNGP LRA. This line item number was a better match for the GALL Report (IV.C1.1-c) for materials, environment, aging effects and components. The project team interviewed the applicant as to the reason for crediting another line item number for this aging effect. The applicant responds that the GALL Report, Chapter V, does not contain a line item for ECCS piping in treated water susceptible to FAC; for this reason, the applicant did not use this line item. Instead the applicant used Table 1 Number Item 3.1.1-25 as a better match with the GALL Report (Section IV.C.1.1-c). By a letter dated August 11, 2005 (ML052280269), the applicant revises the MNGP LRA Table 1 Item Number 3.2.1-14 from “Aging effect is managed by the FAC Program” to “This line item is not used at MNGP.”

On this basis, the project team finds this program acceptable for managing aging of wall thinning due to FAC for some sections of the high-pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) systems. The project team evaluation of the FAC Program is documented in Section 2.19 of this audit and review report.

On the basis of its review, the project team finds that the applicant addressed the aging effect/mechanism as identified in the GALL Report.

3.2.2.1.4 Crack Initiation and Growth due to SCC and IGSCC

In the discussion section of MNGP LRA Table 3.2.1, Item Number 3.2.1-16, the applicant states that:

> Aging effect is managed by the Plant Chemistry Program and BWR Stress Corrosion Cracking Program, or the Plant Chemistry Program and One-Time Inspection Program. Exceptions apply to the NUREG-1801 recommendations for Plant Chemistry Program implementation (refer to Appendix B, Section B2.1.25). Exceptions apply to the NUREG-1801 recommendations for BWR Stress Corrosion Cracking Program implementation (refer to Appendix B, Section B2.1.10).
>
> The Plant Chemistry Program mitigates the aging effect on component surfaces that are exposed to water as the process fluid; the Plant Chemistry Program is used to control water chemistry for impurities (e.g., chloride and sulfate) that accelerate crack initiation and growth. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below system-specific limits based on the EPRI guidelines of TR-1008192 for water chemistry in BWRs (refer to Appendix B, Section B2.1.25).
>
> The One-Time Inspection Program is a new aging management program (AMP). The AMP includes (a) determination of the sample size based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience; (b) identification of the inspection locations in the system or component based on the aging effect; (c) determination of the examination technique, including acceptance criteria that would be effective in managing the aging effect for which the component is examined; and (d) evaluation of the need for follow-up examinations to monitor the progression of any aging degradation (refer to Appendix B, Section B2.1.23).
>
> Application of the BWR Stress Corrosion Cracking AMP as proposed by NUREG-1801 was implemented on a limited basis for this aging effect. The BWR Stress Corrosion Cracking AMP is limited in scope to piping 4 inch or larger, valve bodies, pump casings and reactor vessel attachments containing reactor coolant at temperature above 200 degrees F. Some ESF components susceptible to SCC/IGSCC are not within the defined scope of this program.
>
> Implementation of the One-Time Inspection Program, BWR Stress Corrosion Cracking, and Plant Chemistry Program to manage the aging effect provides additional assurance that the aging effect is progressing very slowly such that the component’s intended function will be maintained during the period of extended operation.

The project team reviewed the GALL Report (V.D2.1-c, V.D2.3-c) and the credited aging management programs listed in the MNGP LRA Table 3.2.1, Item Number 3.2.1-16. The project team noted that the applicant's One-Time Inspection program is not consistent with the GALL Report because the applicant uses a different AMP than the GALL Report's recommendations. However, the One-Time Inspection program does manage the effects of aging based on the project team's technical review of the program merits and GALL recommendations. The pumps, valves, piping and fittings in the ECCS made of CASS and stainless steel in a treated water (int/ext) and treated water/steam environment that are subject to crack initiation and growth due to SCC and IGSCC are managed by the Water Chemistry and BWR Stress Corrosion Cracking Program. The BWR Stress Corrosion Cracking Program and Plant Chemistry Program are consistent with the GALL Report (V.D2.1-c, V.D2.3-c). The One-Time Inspection Program is also credited with managing the aging effects for these components.

In the MNGP LRA, the applicant credits both a One-Time Inspection program, MNGP AMP B.2.1.23, and the Plant Chemistry program, MNGP LRA B.2.1.25, to manage the crack initiation and growth due to SCC and IGSCC. The applicant states that the One-Time Inspection program supplements the effectiveness of the Plant Chemistry program for managing the aging effect/mechanism of crack initiation and growth due to SCC and IGSCC. The project team reviewed the applicant's One-Time Inspection and the Plant Chemistry programs and finds them acceptable for managing aging for crack initiation and growth due to SCC and IGSCC. The project team's evaluation of these aging management programs are documented in Sections 2.23 and 2.25 of this audit and review report.

The applicant states that its MNGP BWR Stress Corrosion Cracking Program is part of the NRC reviewed MNGP ASME Section XI In-Service Inspection Program and provides for condition monitoring of the material susceptible to BWR stress corrosion cracking in accordance with the applicable requirements of ASME Section XI. However, the applicants environmental conditions are not consistent with the GALL Report. On the basis of the applicant's technical information contained in the MNGP LRA and review of the GALL Report technical requirements for this program, the project team finds that the there is a technical basis for the environments listed by the applicant. In addition, the applicant has added manifolds and heat exchangers, which are not listed in the GALL Report, but they are made of similar materials in a similar environment and are managed with approved programs. The project team finds, based on review of technical data in the MNGP LRA and evaluation of technical bases of the GALL Report that the applicant's programs and aging effects are consistent with the GALL Report.

On this basis, the project team finds that the applicant appropriately addressed the aging effects of crack initiation and growth due to SCC and IGSCC for pumps, valves, piping and fittings in ECCS, as identified in the GALL Report.

The project team reviewed the applicant's BWR Stress Corrosion Cracking program and finds it acceptable for managing aging for crack initiation and growth due to SCC and IGSCC for ECCS components. The project team's evaluation of this aging management programs is documented in Section 2.10 of this audit review and report.

On the basis of its review, the project team finds that the applicant addressed the aging effect/mechanisms, as identified in the GALL Report.

3.2.2.1.5 Loss of Material due to General Corrosion, loss of Preload due to Stress Relaxation, and Crack Initiation and Growth due to Cyclic Loading or SCC

In the discussion section of MNGP LRA Table 3.2.1, Item Number 3.2.1-18 , the applicant states that:

> The aging effect loss of material due to general corrosion is managed by the Bolting Integrity Program. There are no bolts with a specified minimum yield strength greater than 150 ksi in the ESF Systems. Therefore, crack initiation and growth due to SCC is not an applicable aging effect Closure bolting preload is effectively addressed in the design (material selection, bolt and nut sizes), installation (torque, lubricant, bolting pattern), and maintenance requirements (retorquing, final checks). Operating temperatures in MNGP systems are below the threshold temperature where thermal creep of the bolting material could occur. MNGP plant operating experience shows no bolted closure failures due to loss of preload.
>
> While not specifically identified as an aging effect in the respective system Table 2, Summary of Aging Management Evaluation, loss of preload is managed for carbon steel closure bolting used in pressure retaining joints by the Bolting Integrity Program. The Bolting Integrity Program manages the loss of preload associated with closure bolting through periodic inspection, material selection, thread lubricant control, assembly and torque requirements, and repair and replacement requirements. These activities of ASME Section XI and plant operating experience and includes consideration of the guidance contained in NUREG-1339, Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants, EPRI TR-104213, Bolted Joint Maintenance & Application Guide, and EPRI NP-5067 Volumes 1 and 2, Good Bolting Practices.

The closure bolting in the high-pressure systems made of carbon steel in an environment of plant indoor/primary containment air that are subject to loss of material due to general corrosion are managed by the Bolting Integrity Program. The project team reviewed the MNGP LRA and it is consistent with the GALL Report (V.E.2-a/b) as noted in the LRA Table 3.2 Note (A), except for an aging mechanism not identified in the GALL Report.

The Bolting Integrity program for this component, material, and environment combination is consistent with the GALL Report, but one of the aging mechanisms is not consistent. While galvanic corrosion is not identified as an aging mechanism in the GALL Report, it would cause loss of preload/function for carbon steel and stainless steel closure bolting used in pressure retaining joints. The project team concluded that this is a conservative approach to managing the aging effect. The Bolting Integrity program (MNGP LRA B2.1.4) was evaluated by the project team and found acceptable for managing aging of loss of material due to general corrosion, loss of preload due to stress relaxation, and crack initiation and growth due to cyclic loading or SCC. The project team's evaluation of the Bolting Integrity program is documented in Section 2.4 of this audit and review report.

The project team reviewed the applicant's technical references and response to project team questions and determined that the applicant has used an appropriate approach to support a conclusion that (1) crack initiation and growth due to SCC and (2) loss of preload due to thermal creep will not occur at MNGP. The project team review and audit concludes that the applicant's

Bolting Integrity program is satisfactory and that the aging effects applicable for closure bolting in the ESF system will be appropriately managed during the period of extended operation.

Based on the technical information provided in the LRA Section 3.2 and review of the MNGP Bolting program, the project team finds that the applicant has appropriately addressed the aging effect/mechanisms of loss of material due to general corrosion, loss of preload due to stress relaxation, and crack initiation and growth due to cyclic loading or SCC for components in the ESF systems as identified in 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 the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the project team finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

#### 3.2.2.2 Aging Management Review Results For Which Further Evaluation Is Recommended

For some line items that were consistent with the GALL Report in the LRA tables 3.2.2-1 through 3.2.2-8 (Table 2s), the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in the MNGP LRA Section 3.2.2.2 against the criteria provided in the SRP-LR Section 3.2.2.2. The project team's assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 line-item in Section 3.2 citing the item in Table 3.2.1.

##### 3.2.2.2.1 Cumulative Fatigue Damage (LRA Section 3.2.2.2.1)

Cumulative fatigue damage is a TLAA, as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The evaluation of this TLAA is performed by NRR DE staff and addressed in Section 4 of the SER related to the LRA.

##### 3.2.2.2.2 Loss of Material Due to General Corrosion

###### 3.2.2.2.2.1 Areas with Stagnant Flow Conditions

The project team reviewed LRA Section 3.2.2.2.2.1 against the criteria in SRP-LR Section 3.2.2.2.2.1, which states:

> The management of loss of material due to general corrosion of pumps, valves, piping, and fittings associated with some of the BWR emergency core cooling systems [high-pressure coolant injection, reactor core isolation cooling, high-pressure core spray, low-pressure core spray, low-pressure coolant injection (residual heat removal)] and with lines to the suppression chamber and to the drywell and suppression chamber spray system should be further evaluated. The existing aging management program relies on monitoring and control of primary water chemistry based on BWRVIP 29 (EPRI TR-103515) for BWRs to

> mitigate degradation.  However, control of primary water chemistry does not preclude loss of material due to general corrosion at locations of stagnant flow conditions. Therefore, verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring.  The GALL Report recommends further evaluation of programs to manage loss of material due to general corrosion to verify the effectiveness of the chemistry control program.   A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

In MNGP LRA Section 3.2.2.2.2.1, the applicant states that loss of material due to general corrosion of piping, fittings, pumps, and valves could occur in the emergency core cooling system and will be managed by the MNGP AMP B2.1.23, One-Time Inspection program, or the combination of the One-Time Inspection program and MNGP AMP B2.1.25, Plant Chemistry program.  The applicant states that when applied in combination with the Plant Chemistry program, the scope of the One-Time Inspection Program is used to verify the effectiveness of the Plant Chemistry program, including a sample of components where the flow of water is low or stagnant conditions exist.

Based on the project team's audit and review of the One-time Inspection program in Section 2.23, it is consistent with the GALL Report.  The Plant Chemistry program was also evaluated in Section 2.25 by the project team and found consistent with the GALL Report.

The applicant, in the MNGP LRA,  included some component types subject to general corrosion (fans/blower housings and turbines) that are not consistent with the GALL Report.  However, the materials, environments, and aging effects are similar.  The project team finds these items to be properly managed during the period of extended operation.  In addition, there are some aging mechanisms covered in the MNGP LRA, Section 3.2.2.2.2, covered by the One-Time Inspection program and Plant Chemistry program, which are not consistent with the GALL Report.  These aging mechanisms are galvanic corrosion and MIC.  The applicant was asked as to why these aging mechanisms were added beyond the scope of License Renewal.  The applicant responds that these mechanisms could cause the aging effect, loss of material and that this is a conservative approach.  The project team concludes that the applicant is taking a conservative approach to aging management and that it is consistent with the GALL Report.

Based on the technical information provided in the LRA Section 3.2 and review of the MNGP LRA One-Time Inspection Program and Plant Chemistry Program, the project team finds that the applicant appropriately addressed the aging effect/mechanism of loss of material due to general corrosion of pumps, valves, piping, and fittings associated with some of the emergency core cooling systems [high-pressure coolant injection, reactor core isolation cooling, high-pressure core spray, low-pressure core spray, low-pressure coolant injection (residual heat removal)] and with lines to the suppression chamber and to the drywell and suppression chamber spray system for components in the ESF systems are consistent with the GALL Report.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.1 for further evaluation.  For those line-items that apply to MNGP LRA Section 3.2.2.2.1, the project team finds that the applicant is consistent with the GALL Report and has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.2.2 Interior and Exterior Surfaces of Carbon Steel Components

The project team reviewed LRA Section 3.2.2.2.2.2 against the criteria in SRP-LR Section 3.2.2.2.2.2, which states:

> Loss of material due to general corrosion could occur in the drywell and suppression chamber spray (BWR) systems header and spray nozzle components, standby gas treatment system components (BWR), containment isolation valves and associated piping, the automatic depressurization system piping and fittings (BWR), emergency core cooling system header piping and fittings and spray nozzles (BWR), and the external surfaces of BWR carbon steel components. The GALL report recommends further evaluation on a plant-specific basis to ensure that the aging effect is adequately managed.

In MNGP LRA Section 3.2.2.2.2.2, the applicant states that this subsection discusses loss of material due to general corrosion of components in the standby gas treatment, containment isolation, and emergency core cooling systems.

The applicant states, in the MNGP LRA, that the aging effect is managed by MNGP AMP B2.1.23, the One-Time Inspection program and/or by MNGP AMP B2.1.32, the System Condition Monitoring program. The System Condition Monitoring program and the One-Time Inspection program are used to manage this aging effect for an air/gas environment.

The MNGP LRA describes the System Condition Monitoring program as an existing plant specific program. This program manages aging effects for normally accessible, external surfaces of piping, tanks, and other components and equipment within the scope of License Renewal. These aging effects are managed through visual inspection and monitoring of external surfaces for leakage and evidence of material degradation.

The MNGP LRA describes the One-Time Inspection program as a new AMP. The scope of this new AMP is to include activities to verify potential long incubation periods for certain aging effect on structures and components. The environments applicable to this item are characteristic of long incubation periods (air/gas environments with the potential for moisture). The One-Time Inspection program was evaluated by the project team and they find it acceptable for managing the aging effects of loss of material due to general corrosion. The evaluation of the One-Time Inspection program is documented in Section 2.23 of the audit and review report.

The project team considers visual inspection to be an examination technique capable of detecting loss of material due to various aging mechanisms (general or galvanic corrosion, etc.) on the exterior surface of components, and the project team considers a once-per-year or once-per-refueling-outage examination frequency to be adequate for detection of this effect before loss of component function will occur. Based on the project team's evaluation of the System Condition Monitoring program (LRA Appendix B2.1.32), the program was found acceptable for managing aging of general corrosion during the period of extended operation. The System Conditioning Monitoring Program is documented in Section 2.32 of this audit review and report.

The System Conditioning Monitoring program and One-Time Inspection program covers aging management in the drywell and suppression chamber spray, systems header and spray nozzle components, standby gas treatment system components, containment isolation valves and associated piping, the automatic depressurization system piping and fittings, emergency core cooling system header piping and fittings and spray nozzles, and the external surfaces of carbon steel components.

The applicant was asked as to why galvanic corrosion and MIC were added beyond the scope of the License Renewal. The applicant responded that these mechanisms could cause the aging effect, loss of material and that this is a conservative approach. The project team concluded that the applicant is taking a conservative approach to aging management and that it is consistent with the GALL Report.

The project team reviewed the applicants programs credited for this aging management for the materials, environment and aging effect/mechanism. The interior and exterior of the drywell and suppression chamber spray, systems header and spray nozzle components, standby gas treatment system components, containment isolation valves and associated piping, the automatic depressurization system piping and fittings, emergency core cooling system header piping and fittings and spray nozzles, and the external surfaces of carbon steel components subject to loss of material. These aging effect/mechanism are managed by the One-time Inspection program and/or the System Condition Monitoring program and are consistent with the GALL Report.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.2 for further evaluation. For those line-items that apply to MNGP LRA Section 3.2.2.2.2, the project team finds that the applicant is consistent with the GALL Report and has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.3 Local Loss of Material Due to Pitting and Crevice Corrosion

3.2.2.2.3.1 Areas with Stagnant Flow Conditions

The project team reviewed LRA Section 3.2.2.2.3.1 against the criteria in SRP-LR Section 3.2.2.2.3.1, which states:

> The management of local loss of material due to pitting and crevice corrosion of pumps, valves, piping, and fittings associated with some of the BWR emergency core cooling system piping and fittings [high-pressure coolant injection, reactor core isolation cooling, high-pressure core spray, low-pressure core spray, low-pressure coolant injection (residual heat removal)] and with lines to the suppression chamber and to the drywell and suppression chamber spray system should be evaluated further. The existing aging management program relies on monitoring and control of primary water chemistry based on EPRI guidelines of TR-105714 for PWRs and BWRVIP 29 (EPRI TR-103515) for BWRs to mitigate degradation. However, control of coolant water chemistry does not preclude loss of material due to crevice and pitting corrosion at locations of stagnant flow conditions. Therefore, verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is

not occurring.  The GALL Report recommends further evaluation of programs to manage the loss of material due to pitting and crevice corrosion to verify the effectiveness of the chemistry control program).  A one-time inspection of select components at susceptible locations is an acceptable method to determine whether an aging effect is not occurring or an aging effect is progressing very slowly so that the component's intended function will be maintained during the period of extended operation.

In MNGP LRA Section 3.2.2.2.3.1, the applicant addressed loss of material due to pitting and crevice corrosion of piping, fittings, pumps, and valves in the emergency core cooling system. Aging effect is managed by the One-Time Inspection program, or the combination of the One-Time Inspection program and Plant Chemistry program.  When applied in combination with the Plant Chemistry program, the scope of the One-Time Inspection program includes activities to verify the effectiveness of the Plant Chemistry program, including a sample of components where the flow of water is low or stagnant conditions exist.  Implementation of the One-Time Inspection program and the Plant Chemistry program to manage the aging effect provides added assurance that the aging effect is not occurring or that the aging effect is progressing very slowly, such that the component's intended function will be maintained during the period of extended operation.

The project team asked the applicant as to why, in some instances, only the One-Time Inspection program is credited for aging management.  The applicant stated that in some instances, the component under the scope of license renewal has an environment, which does not lend itself to benefits from the Plant Chemistry program (low flow stagnant conditions, or an air/gas environment).  The project team determined that the use of the One-Time Inspection Program alone in certain cases, such as no flow conditions, where the use of the plant chemistry program was not a viable option, was acceptable.  The project team concludes, based on MNGP technical procedures, that this is an appropriate aging management method based on the details of the program's sampling locations, frequencies, and corrective actions.

The One-Time Inspection program, or the combination of the One-Time Inspection program and the Plant Chemistry program, is used to manage the aging effects/mechanisms of loss of material due to pitting and crevice corrosion for areas of stagnant flow.  The One-Time Inspection program and Plant Chemistry program were evaluated by the project team and found consistent with the GALL Report for managing aging of pitting and crevice corrosion.  The evaluation of these programs are documented in Sections 2.23 and 2.25 of this audit and review report.

The project team reviewed the applicants programs credited for this aging management for the materials, environment and aging effects/mechanisms.  The pumps, valves, piping, and fittings associated with some of the BWR emergency core cooling system piping and fittings [high-pressure coolant injection, reactor core isolation cooling, high-pressure core spray, low-pressure core spray, low-pressure coolant injection (residual heat removal)] and with lines to the suppression chamber and to the drywell and suppression chamber spray system are subject to local loss of material due to pitting and crevice corrosion.  These aging effects/mechanisms are managed by the One-Time Inspection program and/or Plant Chemistry program and are consistent with the GALL Report.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.3.1 for further evaluation.  For those line-items that apply to

MNGP LRA Section 3.2.2.2.3.1, the project team finds that the applicant is consistent with the GALL Report and has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.3.2 Interior and Exterior Surfaces of Carbon and Stainless Steel Components

The project team reviewed LRA Section 3.2.2.2.3.2 against the criteria in SRP-LR Section 3.2.2.2.3.2, which states:

> Local loss of material from pitting and crevice corrosion could occur in the containment isolation valves and associated piping, and automatic depressurization system piping and fittings (BWR). The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

In MNGP LRA Section 3.2.2.2.3.2, the applicant addresses loss of material due to pitting and crevice corrosion of components in the standby gas treatment, containment isolation, and emergency core cooling systems. The applicant proposes that the aging effect is managed by the One-Time Inspection program, or by the combination of the One-Time Inspection program and Plant Chemistry program.

The One-Time Inspection program is a new AMP. The scope of this new AMP is to include activities to verify potential long incubation periods for certain aging effects on structures and components. The environments applicable to this item are characteristic of long incubation periods (air/gas environments with the potential for moisture). This program is sometimes used by itself in locations where the Plant Chemistry program would not be effective (such as air/gas or low flow stagnant environments). The project team determined that the use of the One-Time Inspection Program alone in certain cases, such as no flow conditions, where the use of the plant chemistry program was not a viable option, was acceptable.

The Plant Chemistry program and One-Time Inspection program were evaluated by the project team and found acceptable for managing aging of local loss of material from pitting and crevice corrosion that could occur in the containment isolation valves and associated piping, and automatic depressurization system piping and fittings. The project team's evaluation of the Plant Chemistry program and One-Time Inspection program are documented in Sections 2.23 and 2.25 of this audit and review report and are found consistent with the GALL Report..

The project team evaluated both of these aging management programs with respect to applications to the materials, environment, and aging effects. The applicant included an additional aging mechanism (galvanic corrosion) not consistent with the GALL Report (V.C.1-a/b, V.D1.8-c, V.D2.1-e). The project team determined that the applicant was using a conservative approach for aging management by including these additional aging mechanisms and that this is consistent with the GALL Report for the aging effect.

The project team reviewed the applicants programs credited for aging management of the materials, environment, and aging effects and found them acceptable. The containment isolation valves and associated piping, and automatic depressurization system piping and fittings are subject to a loss of material from pitting and crevice corrosion. These aging mechanisms are managed by the One-Time Inspection program and Plant Chemistry program, which are consistent with the GALL Report.

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.  For those line-items that apply to MNGP LRA Section 3.2.2.2.3.2, the project team finds that the applicant is consistent with the GALL Report and has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.4 Local Loss of Material Due to Microbiologically Influenced Corrosion

The project team reviewed LRA Section 3.2.2.2.4 against the criteria in SRP-LR Section 3.2.2.2.4, which states:

> Local loss of material due to microbiologically influenced corrosion (MIC) could occur in BWR and PWR containment isolation valves and associated piping in systems that are not addressed in other chapters of the GALL Report.  The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

In LRA Section 3.2.2.2.4, the applicant addresses loss of material due to microbiologically influenced corrosion (MIC) of valves and associated piping in containment isolation.

Although the applicant does not use this line item at MNGP, the loss of material due to microbiologically influenced corrosion is predicted for ESF system valve bodies and associated piping.  The applicant credits a combination of the Plant Chemistry program and the One-Time Inspection program for the aging effect.  The Plant Chemistry program and One-Time Inspection program were evaluated by the project team and found acceptable for managing aging of local loss of material from pitting and crevice corrosion that could occur in the containment isolation valves and associated piping, and automatic depressurization system piping and fittings.  The evaluation of the Plant Chemistry program and One-Time Inspection program are documented in Sections 2.23 and 2.25 of this audit and review report.

The applicant's LRA is consistent with the GALL Report (V.C.1-a/b) for components, materials, environment and programs for managing aging for the containment isolation valves.  Based on the information provided by the applicant, as noted in the MNGP LRA, the project team's review and audit finds that the applicants aging management programs are acceptable for management of aging of MIC  for the containment isolation valves and associated piping.

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.  For those line-items that apply to MNGP LRA Section 3.2.2.2.4, the project team finds that the applicant is consistent with the GALL Report and has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.5 Changes in Properties Due to Elastomer Degradation

The project team reviewed LRA Section 3.2.2.2.5 against the criteria in SRP-LR Section 3.2.2.2.5, which states:

> Changes in properties due to elastomer degradation could occur in seals associated with the standby gas treatment system ductwork and filters. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

In LRA Section 3.2.2.2.5, the applicant addresses the change in material properties of seals in the standby gas treatment system. Aging effect is managed by the One-Time Inspection Program for the internal environment and the System Condition Monitoring Program for the external environment. The System Condition Monitoring program is an existing plant-specific program..

The One-Time Inspection Program is a new AMP. The scope of this new AMP is to include activities to verify potential long incubation periods for certain aging effect on structures and components. The environments applicable to this item are characteristic of long incubation periods (air/gas environments with the potential for moisture). The One-Time Inspection program was evaluated by the project team and found acceptable and consistent with the GALL Report for managing this aging mechanism. The evaluation of the One-Time Inspection program is documented in Section 2.23 of the audit and review report.

The System Condition Monitoring Program is an existing plant-specific program that is based on system engineer monitoring, and it is used to manage the aging effect/mechanisms on system components in the ESF, including elastomer degradation of seals in the standby gas treatment system ductwork and filters. The System Condition Monitoring program was reviewed and evaluated by the project team and found acceptable and consistent with the GALL Report for managing this aging effect/mechanism. The System Condition Monitoring program is documented in Section 2.32 of this audit review and report.

The project team reviewed and determined that the applicant's use of the preventive One-time Inspection program and System Monitoring program (which is periodic) are acceptable and consistent with the GALL Report (V.B.1-b, V.B.2-b) since they will verify the condition of the elastomer seals and provide reasonable assurance that hardening and cracking are not occurring. The project team found that the materials, environment, aging effects and the aging programs are consistent with the GALL Report. These aging effects are managed through visual inspection of internal surfaces and monitoring of external surfaces for leakage and evidence of material degradation.

The project team reviewed the GALL Report, which requires a plant-specific program. The applicant selected two programs to managing the aging for changes in properties due to elastomer degradation, which is consistent with the GALL Report.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.2.2.2.5 for further evaluation. For those line-items that apply to MNGP LRA Section 3.2.2.2.5, the project team finds that the applicant is consistent with the GALL Report and has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3)

3.2.2.2.6 Loss of Material Due to Erosion of Charging Pump Flow Orifices

In LRA Section 3.2.2.2.6, the applicant states that, in accordance with NUREG-1800, Section 3.2.2.2.6, this issue is applicable only to charging pumps in the chemical and volume control systems of PWRs. Therefore, it is not applicable to MNGP.

On the basis that MNGP does not have any components from this group, the project team concurred with the applicant's determination that this aging effect is not applicable to MNGP.

3.2.2.2.7 Buildup of Deposits Due to Corrosion in Drywell and Torus Spray Nozzles and Flow Orifices

The project team reviewed LRA Section 3.2.2.2.7 against the criteria in SRP-LR Section 3.2.2.2.7, which states:

> The plugging of components due to general corrosion could occur in the spray nozzles and flow orifices of the drywell and suppression chamber spray system. This aging mechanism and effect will apply since the spray nozzles and flow orifices are occasionally wetted, even though the majority of the time this system is on standby. The wetting and drying of these components can aid in the acceleration of this particular corrosion. The GALL Report recommends further evaluation to ensure that the aging effect is adequately managed.

In LRA Section 3.2.2.2.7, the applicant addresses plugging of nozzles and flow orifices due to general corrosion of nozzles and flow orifices in the drywell and suppression chamber spray system. The drywell and suppression chamber spray system nozzles are fabricated from copper alloy materials, which are not susceptible to loss of material (plugging of nozzles and flow orifices) due to general corrosion. Therefore, no aging management is required. Copper alloy material is not evaluated in the associated GALL Report line item (V.D2.5-b)

The project team reviewed the GALL Report (V.D2.5-b), which only deals with carbon steel in an air environment for drywell suppression chamber spray systems. The materials at MNGP are made of copper in an air/potential water environment, which is not noted in the GALL Report. After reviewing documentation from the GALL Report for aging effects, materials, and environments, the project team concurred that these nozzles are not subject to aging effects in the environments listed according to material science evaluations (as noted below) and, therefore, they are not susceptible to corrosion product buildup which could cause plugging.

As shown in the Metals Handbook, Volume 13, Corrosion (American Society for Metals), comprehensive tests over a 20-year period under the supervision of ASTM confirmed the suitability of Copper alloys for atmospheric exposure. Additionally, based on the fact that most of the gaseous internal environments to which components within the scope of License Renewal may be subjected include air, nitrogen, carbon dioxide, freon, and halon. Industry experience suggests that copper piping exposed to an internal gaseous operating condition will be resistant to any age-related degradation. Therefore, the component or structure will remain capable of performing its intended functions consistent with the current licensing basis for the period of extended operation.

On the basis of its review of current industry research and operating experience, the project team finds that effects of the listed environments on the listed materials will not result in aging that will be of concern during the period of extended operation. Therefore, the project team concludes that there are no applicable aging effects requiring management for the component material and environment described in the preceding discussion.

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

Conclusion. On the basis of its audit, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the project team determines that (1) those attributes or features for which the applicant claimed consistency with the GALL Report were indeed consistent and (2) the applicant adequately addressed the issues that were further evaluated. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.2.2.3 Aging Management Review Results That Are Not Consistent with the GALL Report or Not Addressed in the GALL Report

In LRA Tables 3.2.2-1 through 3.2.2-8, 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.

#### 3.2.2.3.1 Aging Management Review Results Where No Aging Effects Were Identified (MNGP LRA Tables 3.2.2-1 to 3.2.2-8)

In MNGP LRA Tables 3.2.2-1 through 3.2.2-8, the project team identified AMR line-items that did not have aging effects as a result of the AMR process. In most instances, the applicant identified materials that had no aging effects in the environments they are exposed to during plant operations. The applicant states that no aging effects occur when ESF system components fabricated from:

- copper,
- carbon steel
- nickel alloy,
- stainless steel material,
- CASS, and
- insulation.

These materials are exposed to an environment of:

- plant indoor air (ext./int.),
- primary containment air (ext./int.),
- air/gas (int.),
- gas - instrument air (int.),
- gas - nitrogen (int.),
- lubricating oil (ext/int.), and
- outdoor air protected.

The applicant states that these components fabricated from these materials in these environments do not have aging effects based on material science evaluations of these materials exposed to atmospheric conditions (LRA Section 3.2, note 27, [Metals Handbook, Volume 13, Corrosion, American Society for Metals, 1987, see ref. Section 5]). Specifically, the applicant states that no aging effects occurred when components fabricated from stainless steel material were exposed to a primary containment air, plant indoor air (and outdoor air protected) environment, lubricating oil or gas (instrument air), or when components fabricated from copper alloys were exposed to a primary containment air, plant indoor air environment, lubricating oil or gas (instrument air) environment. The applicant also stated that no aging effects occur when components fabricated from carbon steel in a gas (nitrogen or instrument air) or lubricating oil environment. In addition, the applicant stated that no aging effects occur when components fabricated from CASS or nickel alloys in a primary containment air environment or plant indoor air environment. The applicant states that a material science evaluation for these materials in these environments results in no aging effects.

The GALL Report states that steel, copper, nickel alloy and stainless steel in an environment of plant indoor air (Ext.), gas, and lubricating oil are not subject to any aging mechanisms. The project team reviewed this technical information against the MNGP LRA Tables 3.2.2-1 through 3.2.2-18, and concluded that the applicant analysis of the material and environment combinations will allow components fabricated of these materials in these environments that are in scope of license renewal will perform their intended function during the period of extended operation. This conclusion is based on industry and plant operating experience and technical merit of the GALL Report for material science of these components in these environments.

Based on the fact that stainless steels are highly resistant to corrosion in dry atmospheres in the absence of corrosive species, as cited in Metals Handbook, Ninth Edition, Volume 13, American Society for Metals International, the staff has accepted the position that stainless steel in an indoor, uncontrolled air environment (e.g., plant indoor air) or in a gas environment (e.g., primary containment air inerted with nitrogen) exhibits no aging effect and that the component or structure will therefore remain capable of performing its intended functions consistent with the current licensing basis for the period of extended operation. Based on the fact that both oxygen and moisture must be present to corrode steel, as cited in Metals Handbook, Ninth Edition, American Society for Metals International, steel [carbon or stainless] and copper alloys in a lubricating oil internal environment with no water pooling exhibits no aging effect and that the component or structure will therefore remain capable of performing its intended functions consistent with the current licensing basis for the period of extended operation. Based on the fact that components fabricated from CASS, copper and nickel alloys are highly resistant to corrosion in dry atmospheres in the absence of corrosive species, as cited in the Metals Handbook, Ninth Edition, American Society of Metal International, the staff has accepted the position that CASS, copper and nickel alloys in an indoor (primary containment), uncontrolled air environment (e.g., plant indoor air) or in a gas environment (e.g., plant instrument air) exhibits no aging effect and that the component or structure will therefore remain capable of performing its intended functions consistent with the current licensing basis for the period of extended operation.

In MNGP LRA Tables 3.2.2.4 and 3.2.2.7, there is material insulation for piping and heat exchangers in the HPC and RHR systems exposed to plant indoor air. The MNGP LRA Section 3.2.1, indicates that the GALL Report does not show this material for this component as subject to aging management.

The project team reviewed technical information based on industry experience and concluded that the applicants analysis of the material and environment will allow insulation exposed to plant indoor air to perform their intended function during the period of extended operation.

The project team reviewed the materials and environments for this section and compared this information with the technical references noted above. The ESF components fabricated from carbon steel, nickel alloy, stainless steel, CASS and insulation subjected to plant indoor air (ext./int.), primary containment air (ext./int.), air/gas (int.), gas (instrument air/nitrogen), lubricating oil (ext./int.) and outdoor air are not subject to aging effects/mechanisms.

On the basis of the project team audit and review of the MNGP LRA, the GALL Report and technical references for these materials and environments, the project team finds that the applicant has demonstrated that no aging effects are predicted for the material and environmental combinations reported and that the ESF components fabricated from these materials in the environments listed above will perform their intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3.2 Loss of Material due to General Corrosion for External Surfaces of Steel Components

In the discussion section of MNGP LRA Table 3.2.1, Item Number 3.2.1-10, the applicant states that:

> Aging effect is managed by the System Condition Monitoring program, with the exception of the PCM system guard pipes connected to flued heads. The aging effect is managed by One-Time Inspection program for these PCM system components.
>
> The SRP (NUREG-1800) does not provide a further evaluation discussion as recommended by the GALL Report (NUREG-1801) for this line item. Loss of material due to external corrosion of carbon steel components is predicted for components in air/gas environments exposed to moisture. To manage this aging effect, the System Condition Monitoring program and the One-Time Inspection program will be used. The System Condition Monitoring program is an existing plant-specific program. The One-Time Inspection program is a new aging management program. The System Condition Monitoring program manages the aging effect for normally accessible, external surfaces of piping, tanks, and other components and equipment within the scope of License Renewal. The aging effect is managed through visual inspection and monitoring of external surfaces for leakage and evidence of material degradation (refer to MNGP LRA Appendix B.2.1.22).
>
> Due to the inaccessibility of some components (guard pipes connected to flued heads) in the PCM system, the One-Time Inspection program is a more appropriate AMP than the System Condition Monitoring program. Additionally, the One-Time Inspection program has provisions to increase frequency of inspections based on the results of the first inspection (refer to MNGP LRA Appendix B, Section B2.1.23).

> Implementation of these programs to manage the aging effect provides added assurance that the aging effect is not occurring; or that the aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

The project team could not review this Table 3.2.1-10 line item against the SRP (NUREG-1800) since it does not have a line item with further discussion as recommended by the GALL Report. The applicant states that this subsection discusses loss of material due to general corrosion of external surfaces of carbon steel components and which requires a plant-specific program. The applicant credits managing the aging effect by the System Condition Monitoring program and/or the One-Time Inspection program for the PCM guard pipes connected to the flued heads. The System Condition Monitoring program is used to manage the aging effect in plant/primary containment air external environment. The One-Time Inspection program is also used to manage the aging effect for the same environmental conditions. The One-time Inspection program was evaluated by the project team and found acceptable and consistent with the GALL Report for managing aging of general corrosion of external steel surfaces. The evaluation of the One-Time Inspection program is documented in Section 2.23 of the audit and review report.

The System Condition Monitoring program (MNGP AMP B2.1.32), an existing plant-specific program that is based on system engineer monitoring, is used to manage the aging effect/mechanisms of loss of material due to general or galvanic corrosion for the exterior surfaces of carbon steel components in the ESF systems. The System Condition Monitoring program was evaluated by the project team and found acceptable and consistent with the GALL Report for managing aging of general corrosion of external steel surfaces. The evaluation of the System Condition Monitoring program is documented in Section 2.32 of the audit and review report.

The applicant was asked as to why galvanic corrosion was added beyond the scope of License Renewal. The applicant responded that these aging mechanisms could cause the aging effect, loss of material, and that this is a conservative approach. The project team reviewed this response and concludes that the applicant is taking a conservative approach to aging management.

The project team's review of the MNGP One-Time Inspection and Systems Condition Monitoring programs and its evaluation are documented in Sections 2.23 and 2.32 of this audit review and report. The System Condition Monitoring program is used to manage the aging effect in plant/primary containment air external environment. The One-Time Inspection program is also used to manage the aging effect for the same environmental conditions. 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 general corrosion for external surfaces of steel components exposed to air/gas environments exposed to moisture are effectively managed using the One-Time Inspection and System Condition Monitoring programs. On this basis, the project team finds that management of loss of material due to general corrosion for the line item in Table 3.2.1-10 is acceptable

3.2.2.3.3 <u>Loss of Material due to MIC on ESF Heat Exchangers</u>

The project team noted that several line items in the MNGP LRA related to the ESF heat exchangers that were not consistent with the GALL Report. The ESF heat exchangers material is copper alloy subjected to an environment of raw/treated water (internal) and steam (external) subject to crevice corrosion, pitting corrosion, selective leaching and MIC.  The applicant has stated from Table 3.2.1 of the MNGP LRA, Item Number 3.2.1-12, that:

> Aging effects are managed by the Open-Cycle Cooling Water System Program, One-Time Inspection Program, and Plant Chemistry Program.  Exceptions apply to the NUREG-1801 recommendation for Plant Chemistry Program implementation (refer to Section B2.1.25)  For those ESF heat exchangers that have a raw water environment, consistent with NUREG-1801, the Open-Cycle Cooling Water System Program is credited.  For heat exchangers that have a treated water environment, the On-Time Inspection Program and Plant Chemistry Program are credited.

This line item does not match the information provided for the different aging mechanisms and environments noted in the MNGP LRA, Section 3.2.  The applicant has credited the MNGP AMP B2.1.24, Open-Cycle Cooling Water System program; the MNGP AMP B2.1.23, One-Time Inspection program; and the MNGP AMP B2.1.25, Plant Chemistry program.

The MNGP Open-Cycle Cooling Water System program relies on the implementation of the recommendations of NRC Generic Letter (GL) 89-13 to ensure that the effects of aging on the raw water service water systems will be managed for the period of extended operation.  This program manages the aging effects of metallic components in water systems (e.g., piping and heat exchangers) exposed to raw, untreated (e.g., service) water.  The Open-Cycle Cooling Water System was evaluated by the project team and found acceptable and consistent with the GALL Report.  The evaluation of the Open-Cycle Cooling Water System program is documented in Section 2.24 of this audit review and report.

The MNGP One-Time Inspection program addresses concerns and confirmation for the potential long incubation period for certain aging effects on structures and components.  The One-Time Inspection program was evaluated by the project team and found acceptable and consistent with the GALL Report.  The evaluation of the One-Time Inspection program is documented in Section 2.23 of this audit review and report.

The MNGP Plant Chemistry program mitigates the aging effects on component surfaces that are exposed to water as the process fluid.  The Plant Chemistry program was evaluated by the project team and found acceptable and consistent with the GALL Report.  The evaluation of the Plant Chemistry program is documented in Section 2.25 of this audit review and report.

The project team reviewed the applicants programs credited for aging management of the materials, environment and aging effects.  The heat exchangers in the ESF system are made of copper alloy in a raw water environment that are subject to loss of material due to heat transfer degradation, crevice corrosion, pitting corrosion and MIC.  These aging mechanisms are managed by the Open-Cycle Cooling Water System, which in some instances is augmented by the One-Time Inspection program.  The applicant uses the Open-Cycle Water System Program for managing aging of the raw water side of the heat exchangers (The GALL Report, V.A.6-a/b, V.D1.6-1.-b/c, V.D2.4-a/b).  This program is acceptable for the materials, aging effects and environment specified in the GALL Report.  The project team also reviewed the heat exchangers in environments other than raw water that are managed by the Open-Cycle Cooling Water System program, One-Time Inspection program, and Plant Chemistry program.  These programs are acceptable for the materials, aging effects and environment specified in the GALL

Report. The applicant was asked by the project team as to why other aging mechanisms such as crevice corrosion and pitting were listed, which is beyond the scope of License Renewal. The applicant states that these aging mechanisms could occur. The project team concludes that the applicant was consistent with the GALL Report by being conservative in including other aging mechanisms that could produce the aging effect.

The project team reviewed the MNGP Open-Cooling Water System program, the One-Time Inspection and Plant Chemistry programs and their evaluations are documented in Sections 2.23, 2.24 and 2.25 of this report, respectively. The Open-Cooling Water System program, One-Time Inspection and Plant Chemistry programs are used together to manage crevice corrosion, pitting corrosion, selective leaching, and MIC in a raw water environment. 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 due to MIC on ESF heat exchangers exposed to a raw water environment are effectively managed using the Open-Cooling Water System program, the One-Time Inspection and Plant Chemistry programs. On this basis, the project team finds that management of loss of material due to crevice corrosion, pitting corrosion, selective leaching and MIC for the Item Number 3.2.1-12 to be acceptable.

3.2.2.3.4 Microbiologically Influenced Corrosion on ESF Nozzles

The project team noted that several line items in the MNGP LRA related to the One-Time Chemistry program and the Plant Chemistry program related to ESF nozzles that neither the component, material and environment combination are in the GALL Report. The nozzles are made of copper in a treated water environment subject to MIC. In Table 3.2.1, Item Number 3.2.1-12, the applicant states that:

> Aging effects are managed by the One-Time Inspection program, and Plant Chemistry program. Exceptions apply to the NUREG-1801 recommendation for Plant Chemistry program implementation (refer to Section B2.1.25). For those ESF heat exchangers that have a raw water environment, consistent with NUREG-1801, the Open-Cycle Cooling Water System program is credited. For heat exchangers that have a treated water environment, the One-Time Inspection program and Plant Chemistry program are credited.

The MNGP AMP B2.1.25, Plant Chemistry program mitigates the aging effects on component surfaces that are exposed to water as the process fluid. The program was evaluated by the project team and found acceptable and consistent with the GALL Report. The evaluation of the Plant Chemistry program is documented in Section 2.25 of this audit review and report.

The MNGP AMP B2.1.23, One-Time Inspection program, addresses concerns and confirmation for the potential long incubation period for certain aging effects on structures and components. The program was evaluated by the project team and found acceptable and consistent with the GALL Report. The evaluation of the One-Time Inspection program is documented in Section 2.23 of this audit review and report.

The project team reviewed the applicants programs credited for this aging management for the materials, environment and aging effects. The ESF nozzles are made of copper alloy raw/treated water (internal) and steam (external) subject to crevice corrosion, pitting corrosion, selective leaching and MIC. These aging mechanisms are managed by the One-Time Inspection program, Plant Chemistry program, Open-Cycle Cooling Water and Selective

Leaching of Materials programs. The Open-Cycle Cooling Water Program and Selective Leaching Materials program were evaluated by the project team and found consistent with the GALL Report. The evaluation of these programs is documented in Sections 2.24 and 2.30 of this audit review and report.

The project team asked the why other aging mechanisms such as crevice corrosion, selective leaching and pitting were listed, which is beyond the scope of License Renewal. The applicant states that these aging mechanisms could occur. The project team concludes that the applicant is being conservative in including other aging mechanisms that could produce the aging effect.

The One-Time Inspection program, Plant Chemistry program, Open-Cycle Cooling Water program, and Selective Leaching Materials program are used for crevice corrosion, pitting corrosion, selective leaching and MIC in a raw water (internal) environment and steam (external) environment. 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 crevice corrosion, pitting corrosion, selective leaching and MIC on ESF Nozzles exposed to a raw water/steam environment are effectively managed using the Open-Cooling Water System program, One-Time Inspection program, Plant Chemistry program, and Selective Leaching Materials program. On this basis, the project team finds that management of loss of material due to crevice corrosion, pitting corrosion, selective leaching and MIC for the line items in Table 3.2.1-12 is acceptable.

Conclusion. On the basis of its audit for component groups for which the AMR results are not consistent with the GALL Report or not addressed in the GALL Report, the project team determines that (1) the aging management review results documented by the applicant in the LRA are reasonable and are technically justified, and (2) the applicant adequately addressed the aging management issues that were evaluated. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.2.3 Conclusion

On the basis of its review, the project team concludes that the applicant has demonstrated that the aging effects associated with the engineered safety features system components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3).

The project team also reviewed the applicable FSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the engineered safety features systems, as required by 10 CFR 54.21(d).

## 3.3 MNGP LRA Section 3.3 - Aging Management of Auxiliary Systems

### 3.3.1 Summary of Technical Information in the LRA

In Section 3.3 of the MNGP LRA, the applicant provided the results of its AMRs for the auxiliary systems. In LRA Tables 3.3.2-1 through 3.3.2-18, the applicant provided a summary of the AMRs for components/commodities in the (1) alternate nitrogen system, (2) chemistry sampling system, (3) circulating water system, (4) control rod drive system, (5) demineralized water system, (6) emergency diesel generators system, (7) emergency filtration train system, (8) emergency service water system, (9) fire system, (10) fuel pool cooling and cleanup system, (11) heating and ventilation system, (12) instrument and service air system, (13) radwaste solid and liquid system, (14) reactor building closed cooling water system, (15) reactor water cleanup system, (16) service and seal water system, (17) standby liquid control system, and (18) wells and domestic water 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 LRA Table 3.3.1 (Table 1); and generic and plant-specific notes related to consistency with the GALL Report.

Also the applicant identified for each component type in the LRA Table 3.3.1 those components that are consistent with the GALL Report, those that are consistent with the GALL Report in which further evaluation is recommended, and those that are not addressed in the GALL Report together with the basis of their exclusion.

### 3.3.2 Project Team Evaluation

The project team conducted its audit and review in accordance with SRP-LR Section 3.3.3 and the MNGP audit plan. The project team interviewed the applicant's technical project team and reviewed, in whole or in part the documents listed in Attachment 5 of this report.

Table 3.3-1 presents the project team evaluation for auxiliary system components in the GALL Report.

**Table 3.3-1 Project Team Evaluation for Auxiliary System Components in the GALL Report**

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project team Evaluation |
|---|---|---|---|---|
| Components in spent fuel pool cooling and cleanup (Item Number 3.3.1-01) | Loss of material due to general, pitting, and crevice corrosion | Water chemistry and one time inspection | Plant chemistry program (B2.1.25); One time inspection (B2.1.13) | Consistent with GALL Report, with exceptions, which recommends further evaluation (See Section 3.3.2.2.1.1 and 3.3.2.2.1.2) |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project team Evaluation |
|---|---|---|---|---|
| Linings in spent fuel cooling and cleanup system; seals and collars in ventilation systems (Item Number 3.3.1-02) | Hardening, cracking and loss of strength due to elastomer degradation; loss of material due to wear | Plant specific | Not Applicable | See Section 3.3.2.2.2 |
| Components in load handling, chemical and volume control system (PWR), and reactor water cleanup and shutdown cooling systems (older BWR) (Item Number 3.3.1-03) | Cumulative fatigue damage | TLAA, evaluated in accordance with 10 CFR 52.21(c) | TLAA | This TLAA is evaluated in SER Section 4.3, Metal Fatigue (See Section 3.3.2.2.3) |
| Heat exchangers in reactor water cleanup system (BWR) (Item Number 3.3.1-04) | Crack initiation and growth due to SCC or cracking | Plant specific | Not applicable | See Section 3.3.2.2.4 |
| Components in ventilation systems, diesel fuel oil system, and emergency diesel generator systems; external surfaces of carbon steel components (Item Number 3.3.1-05) | Loss of material due to general, pitting, and crevice corrosion, and MIC | Plant specific | Fire water system program (B2.1.18); Fire protection program (2.1.17); System condition monitoring program (B2.1.32); One-time inspection program (B2.1.23); | Consistent with GALL Report, which recommends further evaluation (See Section 3.3.2.2.5) |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project team Evaluation |
|---|---|---|---|---|
| Components in reactor coolant pump oil collect system of fire protection (Item Number 3.3.1-06) | Loss of material due to galvanic, general, pitting, and crevice corrosion | One-time inspection | Not applicable | See Section 3.3.2.2.6 |
| Diesel fuel oil tanks in diesel fuel oil system and emergency diesel generator system (Item Number 3.3.1-07) | Loss material due to general, pitting, and crevice corrosion, MIC, and biofouling | Fuel oil chemistry and one-time inspection | Fuel oil chemistry (B2.1.20); One-time inspection (B2.1.23) | Consistent with GALL Report, which recommends further evaluation (See Section 3.3.2.2.7) |
| Piping, pump casing, and valve body and bonnets in shutdown cooling system (older BWR) (Item Number 3.3.1-08 | Loss of material due to pitting and crevice corrosion | Water chemistry and one time inspection | Plant chemistry program (B2.1.25); One-time inspection (B2.1.23); Compressed air monitoring (B.2.1.14) | Consistent with GALL Report, which recommends further evaluation (See Section 3.3.2.2.1.2) |
| 3.3.1-09 | PWR Only (See Section 3.3.2.2.9) | | | |
| Neutron absorbing sheets in spent fuel storage racks (Item Number 3.3.1-10) | Reduction of neutron absorbing capacity and loss of material due to general corrosion (Boral, boron steel) | Plant specific | Not Applicable | See Section 3.3.2.2.10 |
| New fuel rack assembly (Item Number 3.3.1-11) | Loss of material due to general , pitting, and crevice corrosion | Structures monitoring | Not applicable | See Section 3.3.2.1 |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project team Evaluation |
|---|---|---|---|---|
| Neutron absorbing sheets in spent fuel racks (Item Number 3.3.1-12) | Reduction of neutron absorbing capacity due to Boraflex degradation | Boraflex monitoring | Not applicable. | Not Applicable |
| Spent fuel storage racks and valves in spent fuel pool cooling and cleanup (Item Number 3.3.1-13) | Crack initiation and growth due to stress corrosion cracking | Water chemistry | Plant chemistry program (B2.1.25) | High density aluminum spent fuel storage racks.<br><br>See Section 3.3.2.1 |
| Closure bolting and external surfaces of carbon steel and low-alloy steel components (Item Number 3.3.1-14) | Loss of material due to boric acid corrosion | Boric acid corrosion | Not applicable. MNGP does not utilize boric acid | Not Applicable |
| Components in or serviced by closed-cycle cooling water system (Item Number 3.3.1-15) | Loss of material due to general, pitting, and crevice corrosion, and MIC | Closed-cycle cooling water system | Closed-cycle cooling water system program (B2.1.13); One-time inspection (B2.1.23) | Consistent with GALL Report. (See Section 3.3.2.1.3) |
| Cranes including bridge and trolleys and rail system in load handling system (Item Number 3.3.1-16) | Loss of material due to general corrosion and wear | Overhead heavy load and light load handling systems | Inspection of overhead heavy load (related to refueling) handling systems (B2.1.22) | Consistent with GALL Report. (See Section 3.3.2.1) |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project team Evaluation |
|---|---|---|---|---|
| Components in or serviced by open-cycle cooling water systems (Item Number 3.3.1-17) | Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling; buildup of deposit due to biofouling | Open-cycle cooling water system | Open-cycle cooling water system program (B2.1.24); One-time inspection (B2.1.23) | Consistent with GALL Report. (See Section 3.3.2.1) |
| Buried piping and fittings (Item Number 3.3.1-18) | Loss of material due to general, pitting, and crevice corrosion, and MIC | Buried piping and tank surveillance<br><br>or<br><br>Buried piping and tanks inspection | Buried piping & tanks inspection program (B2.1.5); Bolting integrity (B2.1.4) | Consistent with GALL Report, which recommends further evaluation (See Section 3.3.2.2.11) |
| Components in compressed air system (Item Number 3.3.1-19) | Loss of material due to general and pitting corrosion | Compressed air monitoring | Compressed air monitoring (B.2.14) | Consistent with GALL. (See Section 3.3.2.1) |
| Components (doors and barrier penetration seals) concrete structures in fire protection (Item Number 3.3.1-20) | Loss of material due to wear; hardening and shrinkage due to weathering | Fire protection | Fire protection program (B2.1.17) | Consistent with GALL Report. (See Section 3.3.2.1) |
| Components in water-based fire protection (Item Number 3.3.1-21) | Loss of material due to general, pitting, crevice, and galvanic corrosion, MIC, and biofouling | Fire water system | Fire protection program (B2.1.17); Fire water system program (B2.1.18) | Consistent with GALL Report. (See Section 3.3.2.1) |
| Components in diesel fire system (Item Number 3.3.1-22) | Loss of material due to galvanic, general, pitting, and crevice corrosion | Fire protection and fuel oil chemistry | Line item not used. | See Section 3.3.2.1 |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project team Evaluation |
| --- | --- | --- | --- | --- |
| Tanks in diesel fuel oil system (Item Number 3.3.1-23) | Loss of material due to general, pitting, and crevice corrosion | Above ground carbon steel tanks | Not applicable. | Not Applicable |
| Closure bolting (Item Number 3.3.1-24) | Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and SCC | Bolting integrity | Bolting integrity (B2.1.4) | Consistent with GALL Report. (See Section 3.3.2.1) |
| Components in contact with sodium pentaborate solution in standby liquid control system (Item Number 3.3.1-25) | Cracking initiation and growth due to SCC | Water chemistry | Not applicable. | Not Applicable |
| Components in reactor water cleanup system (Item Number 3.3.1-26) | Crack initiation and growth due to SCC and IGSCC | Reactor water cleanup system inspection | Plant chemistry program (B2.1.25); One-time inspection (B2.1.23) | Different programs apply. (See Section 3.3.2.1) |
| Components in shutdown cooling system (Item Number 3.3.1-27) | Crack initiation and growth due to SCC | BWR stress corrosion cracking and water chemistry | BWR stress corrosion cracking (B2.1.10: Plant chemistry program (B2.1.25); One-time inspection (B2.1.23); Closed-cycle cooling water (B2.1.13) | Consistent with GALL Report. (See Section 3.3.2.1) |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project team Evaluation |
|---|---|---|---|---|
| Components in shutdown cooling system (Item Number 3.3.1-28) | Loss of material due to pitting and crevice corrosion, and MIC | Closed-cycle cooling water system | This line item was not used. | This line item was not used. |
| Components (aluminum, bronze, brass, cast iron, cast steel) in open-cycle and closed-cycle cooling water systems, and ultimate heat sink (Item Number 3.3.1-29) | Loss of material due to selective leaching | Selective leaching of materials | Selective leaching of materials (B2.1.30) | Consistent with GALL Report. (See Section 3.3.2.1) |
| Fire barriers, walls, ceilings, and floors in fire protection (Item Number 3.3.1-30) | Concrete cracking and spalling due to freeze-thaw, aggressive chemical attack, and reaction with aggregates; loss of material due to corrosion of embedded steel | Fire protection and structures monitoring | Fire protection program (B2.1.17); Structures monitoring program (B2.1.31) | Consistent with GALL Report. (See Section 3.3.2.1) |

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

For AMRs that the applicant states are consistent with the GALL Report, the project team conducted its audit and review to determine if the applicant's references to the GALL Report in the MNGP LRA are acceptable.

The project team reviewed its assigned MNGP 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 systems components that are subject to an AMR.

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 claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the project team finds that the applicant appropriately addressed the aging effects/mechanisms, as identified by the GALL Report and that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.3.2.2 Aging Management Review Results For Which Further Evaluation Is Recommended

For some line items that were consistent with the GALL Report in the LRA tables 3.3.2-1 through 3.3.2-8 (Table 2s), the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provide in LRA Section 3.3.2.2 against the criteria provided in the SRP-LR section 3.3.2.2. The project team's assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 lin-item in Section 3.3 citing the item in Table 3.3.1.

#### 3.3.2.2.1 Loss of Material Due to General, Pitting, and Crevice Corrosion

##### 3.3.2.2.1.1 Spent Fuel Pool Cooling Heat Exchangers

The project team reviewed MNGP LRA Section 3.3.2.2.1.1 against the criteria in SRP-LR Section 3.3.2.2.1.1, which states:

> Loss of material due to general, pitting, and crevice corrosion could occur in the channel head and access cover, tubes, and tubesheets of the heat exchanger in the spent fuel pool cooling and cleanup [system]. The water chemistry program relies on monitoring and control of reactor water chemistry based on EPRI guidelines of BWRVIP-29 (TR-103515) for water chemistry in BWRs to manage the effects of loss of material from general, pitting or crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause general, pitting, or crevice corrosion. Therefore, verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from general, pitting, and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In MNGP LRA Section 3.3.2.2.1.1, the applicant states that the One-Time Inspection program is applied in combination with the Plant Chemistry program. The scope of this new AMP includes activities to verify the effectiveness of the Plant Chemistry program, including a sample of components where the flow of water is low or stagnant conditions exist. Implementation of the One-Time Inspection program and the Plant Chemistry program to manage the aging effect provides added assurance that aging effect is not occurring or that the aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation. The applicant states that in some cases where the Plant

Chemistry program is not a viable option and aging effects/mechanisms are not expected to be significant, the One-Time Inspection program alone is credited for managing aging effects.

The project team reviewed and determined that the applicant's Plant Chemistry program exceptions were non-technical, the program is based on a more recent EPRI document for BWR water chemistry, versus the GALL Report recommended EPRI document BWRVIP-29 (TR-103515). The project team determined that the use of a more recent issue of the BWRVIP chemistry program document was acceptable. The project team determined that the use of the One-Time Inspection program alone in certain cases, such as no flow conditions, where the use of the Plant Chemistry program was not a viable option, was acceptable. The One-Time Inspection program has provisions to increase frequency of inspections based on the results of the first inspection. The project team determined that the One-Time Inspection program provisions to increase frequency of inspections were conservative and ensured that aging effects were managed. These aging management programs are appropriate for the aging effects/mechanisms identified and provide assurance that the aging effects/mechanisms are effectively managed through the period of extended operation. The Plant Chemistry program and the One-Time Inspection program were evaluated by the project team and found acceptable for managing aging degradation. The evaluations are documented in Sections 2.25 and 2.23, respectively, of this audit and review report.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.1.1 for further evaluation. For those line-items that apply to MNGP LRA Section 3.3.2.2.1.1, the project team finds that the applicant is consistent with the GALL Report and 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).

3.3.2.2.1.2 Spent Fuel Pool Cooling Piping, Valves, Filters, and Ion Exchangers

The project team reviewed LRA Section 3.3.2.2.1.2 against the criteria in SRP-LR Section 3.3.2.2.1.2, which states:

> Loss of material due to pitting and crevice corrosion could occur in the piping, filter housing, valve bodies, and shell and nozzles of the ion exchanger in the spent fuel pool cooling and cleanup system. The water chemistry program relies on monitoring and control of reactor water chemistry based on EPRI guidelines of BWRVIP-29 (TR-103515) for water chemistry in BWRs to manage the effects of loss of material from pitting or crevice corrosion. However, high concentrations of impurities at crevices and locations of stagnant flow conditions could cause pitting or crevice corrosion. Therefore, verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material from pitting and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of select components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In MNGP LRA Section 3.3.2.2.1.2, the applicant states that loss of material due to pitting and crevice corrosion of these components is managed by the combination of the One-Time

Inspection program and the Plant Chemistry program, solely the One-Time Inspection program, or the Compressed Air Monitoring program. The scope of One-Time Inspection program includes activities to verify the effectiveness of the Plant Chemistry program, including a sample of components where the flow of water is low or stagnant conditions exist. Implementation of the One-Time Inspection program and the Plant Chemistry program to manage the aging effect provides added assurance that aging effect is not occurring or that the aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation. In some cases where the Plant Chemistry program is not a viable option and aging effects/mechanisms are not expected to be significant, the One-Time Inspection program alone is credited for managing aging effects. The Compressed Air Monitoring program is used to manage loss of material of stainless steel valve bodies of the Instrument and Service Air System in an air/gas environment (MNGP conservatively treats components with a "wet air/gas" environment in the same manner as treated water). The scope of MNGP's Compressed Air Monitoring program includes procedurally required testing for water vapor, oil content, and particulate to ensure the instrument air quality has acceptable levels of contaminants. In addition, external visual inspections of the Instrument and Service Air Systems are performed once per cycle, for corrosion and system pressure boundary degradation.

The project team reviewed and determined that the applicant’s Plant Chemistry program exceptions were non-technical, the program is based on a more recent EPRI document for BWR water chemistry, versus the GALL Report recommended EPRI document BWRVIP-29 (TR-103515). The project team determined that the use of the One-Time Inspection program alone in certain cases, such as no flow conditions, where the use of the Plant Chemistry program was not a viable option, was acceptable. The One-Time Inspection program has provisions to increase frequency of inspections based on the results of the first inspection. The Compressed Air Monitoring program includes procedurally required testing for water vapor, oil content, and particulate to ensure the instrument air quality does not have unacceptable levels of contaminants. In addition, external visual inspections of the Instrument and Service Air System are performed once per cycle, for corrosion and system pressure boundary degradation. Engineering personnel are required to walkdown the system and look for vibrating piping, leaks, or other indications of pending failures. These aging management programs are appropriate for the aging effects/mechanisms identified and provide assurance that the aging effects/mechanisms are effectively managed through the period of extended operation. The Plant Chemistry program, the One-Time Inspection program, and the Compressed Air Monitoring program were evaluated by the project team and found acceptable for managing aging degradation. The evaluations are documented in Sections 2.25, 2.23, and 2.14 of this audit and review report, respectively.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.1.2 for further evaluation. For those line-items that apply to MNGP LRA Section 3.3.2.2.1.2, the project team finds that the applicant is consistent with the GALL Report and has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.2 Hardening and Cracking or Loss of Strength Due to Elastomer Degradation or Loss of Material Due to Wear

MNGP LRA Section 3.3.2.2.2 is reviewed by the NRR-DE staff and will be addressed separately in Section 4 of the SER related to the MNGP LRA.

3.3.2.2.3 Cumulative Fatigue Damage

Cumulative fatigue is a time-limited aging analysis (TLAA) as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c). The evaluation of this TLAA is addressed in Section 4 of the SER related to the LRA and is reviewed by the NRR DE staff.

3.3.2.2.4 Crack Initiation and Growth Due to Cracking or Stress Corrosion

The project team reviewed LRA Section 3.3.2.2.4 against the criteria in SRP-LR Section 3.3.2.2.4, which states:

> Crack initiation and growth due to SCC could occur in the regenerative and non-regenerative heat exchanger components in the reactor water cleanup system of BWR plants. The GALL Report recommends further evaluation to ensure that these aging effects are managed adequately.

In MNGP LRA Section 3.3.2.2.4, the applicant states that cracking due to SCC is not applicable to MNGP Reactor Water Cleanup System heat exchangers. Materials science evaluation for the carbon steel, Reactor Water Cleanup System heat exchanger components in-scope for License Renewal in the treated water environment does not support the occurrence of the aging effect for these components. Therefore, no aging management is required.

The project team reviewed and determined that the applicant's assessment that SCC did not apply to the Carbon Steel shell was acceptable.

The project team finds that the applicant's assessment that SCC does not apply to the carbon steel shell. Therefore, the project team concluded that the applicant's further evaluation is acceptable on the basis that SRP-LR Section 3.3.2.2.4 is not applicable to MNGP.

3.3.2.2.5 Loss of Material Due to General, Microbiologically Influenced, Pitting, and Crevice Corrosion

The project team reviewed the MNGP LRA Section 3.3.2.2.5 against the criteria in SRP-LR Section 3.3.2.2.5, which states:

> Loss of material due to general, microbiologically influenced, pitting, and crevice corrosion could occur in the piping and filter housing and supports in the control room area, the auxiliary and radwaste area, the primary containment heating and ventilation systems; in the piping of the diesel generator building ventilation system, in the above ground piping, and fittings, valves, and pumps in the diesel fuel oil system and in the diesel engine starting air, combustion air intake, and combustion air exhaust subsystems in the EDG system. Loss of material due to general, pitting, crevice and microbiologically influenced corrosion could occur in the duct fittings, access doors, and closure bolts, equipment frames and housing of the duct, due to pitting and crevice corrosion could occur in the heating/cooling coils of the air handler heating/cooling, and due to general corrosion could occur on the external surfaces of all carbon steel 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.

In MNGP LRA Section 3.3.2.2.5, the applicant states that loss of material due to corrosion of mechanical components could occur on surfaces exposed to air/gas under a range of atmospheric conditions. For the internal surfaces of mechanical components in the Emergency Diesel Generators, Emergency Filtration Train, and Heating and Ventilation systems of auxiliary systems, the One-Time Inspection Program is credited with managing the aging effect. For the external surfaces of mechanical components in all auxiliary systems, one or more of the following programs is credited with managing the aging effect, include Fire Water System Program, Fire Protection Program, System Condition Monitoring Program, and One-Time Inspection Program.

The project team reviewed and determined that the applicant’s Fire Water System Program and the Fire Protection Program together include activities that manage aging effects in the water based fire protection system piping and components in accordance with applicable NFPA recommendations and activities that manage aging effects for components in the Fire System, including components for the diesel fire pump. The project team also reviewed the System Condition Monitoring Program and determined that this existing plant-specific AMP manages aging effects for normally accessible external surfaces of piping, tanks, and other components and equipment within the scope of License Renewal. These aging effects are managed through visual inspection and monitoring of external surfaces for leakage and evidence of material degradation. The project team also determined that the One-Time Inspection Program activities include a sample of components where flow is low or stagnant conditions exist. Implementation of the One-Time Inspection Program provides added assurance that aging effect is not occurring or that the aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation. Additionally, the One-Time Inspection Program has provisions to increase frequency of inspections based on the results of the first inspection. These aging management programs are appropriate for the aging effects/mechanisms identified and provide assurance that the aging effects/mechanisms are effectively managed through the period of extended operation. The project team reviewed the applicant’s Fire Water System Program, the Fire Protection Program, the One-Time Inspection Program, and the System Condition Monitoring Program and finds them acceptable for managing aging degradation. The evaluation is documented in Sections 2.18, 2.17, 2.23, and 2.32, of this audit and review report, respectively.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.5 for further evaluation. For those line-items that apply to MNGP LRA Section 3.3.2.2.5, the project team finds that the applicant is consistent with the GALL Report and has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.6 <u>Loss of Material Due to General, Galvanic, Pitting, and Crevice Corrosion</u>

The project team reviewed the MNGP LRA Section 3.3.2.2.6 against the criteria in SRP-LR Section 3.3.2.2.6, which states:

> Loss of material due to general, galvanic, pitting, and crevice corrosion could occur in tanks, piping, valve bodies, and tubing in the reactor coolant pump oil

collection system in fire protection. The fire protection program relies on a combination of visual and volumetric examinations in accordance with the guidelines of 10 CFR Part 50 Appendix R and Branch Technical Position 9.5-1 to manage loss of material from corrosion. However, corrosion may occur at locations where water from wash downs may accumulate. Therefore, verification of the effectiveness of the program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general, galvanic, pitting, and crevice corrosion to verify the effectiveness of the program. A one-time inspection of the bottom half of the interior surface of the tank of the reactor coolant pump oil collection system is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In MNGP LRA Section 3.3.2.2.6, the applicant addresses loss of material for components in the reactor coolant pump oil collection system in fire protection. MNGP is not designed with a reactor coolant pump (recirculation pump) oil collection system because these pumps are contained within the primary containment, which is inerted with nitrogen during normal operation.

The project team reviewed and determined that MNGP does not have the components covered by this SRP Section.

On the basis of its review, the project team determined that MNGP does not have any components covered by SRP-LR Section 3.3.2.2.6. The project team finds that this aging effect is not applicable to MNGP.

3.3.2.2.7 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion, and Biofouling

The project team reviewed MNGP LRA Section 3.3.2.2.7 against the criteria in SRP-LR Section 3.3.2.2.7, which states:

> Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling could occur on the internal surface of tanks in the diesel fuel oil system and due to general, pitting, and crevice corrosion and MIC in the tanks of the diesel fuel oil system in the EDG system. The existing AMP relies on the fuel oil chemistry program for monitoring and control of fuel oil contamination in accordance with the guidelines of ASTM Standards D4057, D1796, D2709 and D2276 to manage loss of material due to corrosion or biofouling. Corrosion or biofouling may occur at locations where contaminants accumulate. Verification of the effectiveness of the chemistry control program should be performed to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage corrosion/biofouling to verify the effectiveness of the program. A one-time inspection of selected components at susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In MNGP LRA Section 3.3.2.2.7, the applicant states that its Fuel Oil Chemistry program manages loss of material for all components wetted by fuel oil. The effectiveness of the Fuel Oil Chemistry program is confirmed by the One-Time Inspection program. The MNGP Fuel Oil Chemistry program is an existing program using existing diesel oil system procedures that encompass the NUREG-1801 program requirements. The Fuel Oil Chemistry program mitigates and manages aging effects on the surfaces wetted by fuel oil of fuel oil storage tanks and associated components. This also includes the tank and other components supplying fuel to the diesel fire pump. The program includes (a) surveillance and monitoring procedures for maintaining fuel oil quality by controlling contaminants in accordance with applicable ASTM Standards, (b) periodic draining of water from fuel oil tanks, (c) periodic or conditional visual inspection of internal surfaces or wall thickness measurements (e.g., by UT) from external surfaces of fuel oil tanks, and (d) one-time inspections of a representative sample of components in systems that contain fuel oil. The One-Time Inspection program includes (a) determination of the sample size based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience; (b) identification of the inspection locations in the system or component based on the aging effect; (c) determination of the examination technique, including acceptance criteria that would be effective in managing the aging effect for which the component is examined; and (d) evaluation of the need for follow-up examinations to monitor the progression of any aging degradation

The project team reviewed the applicant's Fuel Oil Chemistry program and the One-Time Inspection program and finds them acceptable for managing aging degradation. The evaluation is documented in Sections 2.20 and 2.23 of this audit and review report, respectively.

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. For those line-items that apply to MNGP LRA Section 3.3.2.2.7, the project team finds that the applicant is consistent with the GALL Report and has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

#### 3.3.2.2.8 Quality Assurance for Aging Management of Non-Safety Related Components

Quality assurance for aging management of non-safety related components is reviewed by NRR DIPM project team and addressed in Section 3.0.4 of the SER related to the LRA.

#### 3.3.2.2.9 Crack Initiation and Growth Due to Stress Corrosion Cracking and Cyclic Loading (for Heat Exchangers in Chemical and Volume Control System)

In LRA Section 3.3.2.2.9, the applicant states that this discussion is applicable to PWR systems only.

On the basis that MNGP is a BWR, the project team finds that this aging effect is not applicable to MNGP.

#### 3.3.2.2.10 Reduction of Neutron Absorbing Capacity and Loss of Material Due to General Corrosion

The project team reviewed MNGP LRA Section 3.3.2.2.10 against the criteria in SRP-LR Section 3.3.2.2.10, which states:

> Reduction of neutron-absorbing capacity and loss of material due to general corrosion could occur in the neutron-absorbing sheets of the spent fuel storage rack in the spent fuel storage. The GALL Report recommends further evaluation to ensure that these aging effects are adequately managed.

In MNGP LRA Section 3.3.2.2.10, the applicant states that its MNGP AMP B2.1.25 Plant Chemistry program is used to manage the aging effects loss of material and reduction of neutron-absorbing capacity of boral in treated water environment due to crevice, galvanic, MIC, and pitting corrosion and the aging effect cracking due to stress corrosion cracking by ensuring that corrosive ion concentrations do not exceed acceptable limits and by limiting the amount of impurities in the water. General corrosion is not applicable since boral/aluminum develops a strongly bonded oxide film with excellent corrosion resistance. The One-Time Inspection program will verify the effectiveness of the Plant Chemistry program by confirming the absence of aging effects on boral coupon samples stored in the spent fuel pool. Aging effects that could affect rack integrity or neutron absorption characteristics are not expected since none have been observed during coupon sample evaluations conducted over the past 20 years.

The project team reviewed and determined that reduction of neutron-absorbing capacity and loss of material due to general corrosion will be managed by the Plant Chemistry program, supplemented by the One-Time Inspection program. The One-Time Inspection of boral coupon test specimens is performed to confirm that no significant aging degradation will occur and the neutron absorbing capability of the boral has not been reduced. The One-Time Inspection program has provisions to increase frequency of inspections based on the results of the first inspection.

These aging management programs are appropriate for the aging effects/mechanisms identified and provide assurance that the aging effects/mechanisms are effectively managed through the period of extended operation. The Plant Chemistry program and the One-Time Inspection program were evaluated by the project team and found acceptable for managing aging degradation. The evaluations are documented in Sections 2.25 and 2.23 of this audit and review report, respectively.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.10 for further evaluation. For those line-items that apply to MNGP LRA Section 3.3.2.2.10, the project team finds that the applicant is consistent with the GALL Report and has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.11 <u>Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion</u>

The project team reviewed MNGP LRA Section 3.3.2.2.11 against the criteria in SRP-LR Section 3.3.2.2.11 which states:

> Loss of material due to general, pitting, and crevice corrosion and MIC could occur in the underground piping and fittings in the open-cycle cooling water system (SW system) and in the diesel fuel oil system. The buried piping and tanks inspection program relies on industry practice, frequency of pipe excavation, and operating experience to manage the effects of loss of material

> from general, pitting, and crevice corrosion and MIC. The effectiveness of the buried piping and tanks inspection program should be verified to evaluate an applicant's inspection frequency and operating experience with buried components, ensuring that loss of material is not occurring.

In MNGP LRA Section 3.3.2.2.11, the applicant states that loss of material due to general, pitting, crevice corrosion, and MIC as well as galvanic corrosion and selective leaching for buried valve bodies, piping and fittings is managed by the Buried Piping & Tanks Inspection program. The Bolting Integrity program manages loss of material due to general, pitting, crevice corrosion, and MIC as well as galvanic corrosion for buried fasteners. The Buried Piping & Tanks Inspection program consists of preventive and condition monitoring measures to manage the aging effect. Preventive measures consist of protective coatings and/or wraps on buried components. Condition monitoring consists of periodic inspections of buried components. MNGP operating experience has shown no buried pipe/tank failures for components in-scope for License Renewal. The Bolting Integrity program consists of guidelines on materials selection, strength and hardness properties, installation procedures, lubricants and sealants, corrosion considerations in the selection and installation of pressure-retaining bolting for nuclear applications, and inspection techniques.

The project team reviewed and determined that the Buried Piping & Tanks Inspection program provides reasonable assurance that buried pipes, components, and tanks will be adequately managed for aging effects during the period of extended operation. The MNGP Bolting Integrity program references and invokes the provisions of the Buried Piping and Tanks Inspection program as the implementation program for the inspection of these components. The Buried Piping & Tanks Inspection program, and the Bolting Integrity program were evaluated by the project team and found acceptable for managing aging degradation. The evaluations are documented in Sections 2.5 and 2.4, respectively, of this audit and review report.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.3.2.2.11 for further evaluation. For those line-items that apply to MNGP LRA Section 3.3.2.2.11, the project team finds that the applicant is consistent with the GALL Report and 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).

<u>Conclusion</u>. On the basis of its audit for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the project team determines that (1) those attributes or features for which the applicant claimed consistency with the GALL Report were indeed consistent and (2) the applicant adequately addressed the issues that were further evaluated. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

#### 3.3.2.3 <u>Aging Management Review Results That Are Not Consistent with the GALL Report or Not Addressed in the GALL Report</u>

In MNGP LRA Tables 3.3.2-1 through 3.3.2-18, 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.

3.3.2.3.1 AMR Results Where No Aging Effects Were Identified (MNGP LRA Tables 3.3.2-1 through 3.3.2-18)

In MNGP LRA Tables 3.3.2-1 through 3.3.2-18, the applicant identified line items where no aging effects were identified as a result of the aging review process.

In MNGP LRA Tables 3.3.2-1 through 3.3.2-18 the applicant identified AMR results line-items where no aging effects were identified as a result of the aging review process. Specifically, the applicant states that no aging effects occurred when components fabricated from Bronze, Carbon Steel, Cast Austenitic Stainless Steel (CASS), Cast Iron, Copper Alloy, Galvanized Steel, and Stainless Steel materials were exposed to Air/Gas (Internal [Int.] and External [Ext.]), Concrete (Ext.), Dry Air (Int.), Gas - Halon (Int.), Gas - Instrument Air (Int.), Gas - Nitrogen (Int.), Gas - Refrigerant (Int.), Lubricating Oil (Int. And Ext.), Plant Indoor Air (Int. and Ext.), and Primary Containment Air (Ext.) environments. The applicant states that material science evaluation for these materials in these environments result in no aging effects for these components and materials. No aging effects are considered to be applicable to components fabricated from the above list of materials material exposed to the above list of environments.

As shown in the Metals Handbook, Volume 13, Corrosion (American Society for Metals), comprehensive tests over a 20-year period under the supervision of ASTM confirmed the suitability of copper alloys for atmospheric exposure. Additionally, based on the fact that most of the gaseous internal environments to which components within the scope of License Renewal may be subjected include air, nitrogen, carbon dioxide, freon, and halon. Industry experience suggests that copper piping exposed to an internal gaseous operating condition will be resistant to any age-related degradation. Therefore, the component or structure will remain capable of performing its intended functions consistent with the current licensing basis for the period of extended operation.

As shown in the Metals Handbook, Volumes 1 and 13 (American Society for Metals), both oxygen and moisture must be present to corrode steel. Experience has shown that general corrosion of steel (includes carbon steel, alloy steel, gray cast iron, and galvanized steel) would only be applicable if it were exposed to outdoor environments or indoor environments that would promote condensation of water on the external surfaces of components. Therefore, the component or structure will remain capable of performing its intended functions consistent with the current licensing basis for the period of extended operation.

As shown in Metals Handbook, Volumes 3 and 13 (American Society for Metals), stainless steels are highly resistant to corrosion in dry atmospheres in the absence of corrosive species (which would be reflective of indoor uncontrolled air or primary containment air inerted with nitrogen). Therefore, the component or structure will remain capable of performing its intended functions consistent with the current licensing basis for the period of extended operation.

As shown in the Metals Handbook, Volumes 1 and 13 (American Society for Metals), both oxygen and moisture must be present to corrode steel. Components are not subject to wetting if their surfaces remain oil-coated. Therefore, steel [carbon or stainless] in a lubricating oil environment with no water pooling exhibits no aging effect, and the component or structure will remain capable of performing its intended functions consistent with the current licensing basis for the period of extended operation.

For carbon steel embedded in concrete, loss of material due to general corrosion could occur in an aggressive environment. Description of an aggressive environment is pH < 5.5, chlorides > 500 ppm, or sulfates > 1500 ppm. Plant documents confirm that the below-grade environment is not aggressive. MNGP data indicates that the pH > 7, chlorides < 100 ppm, and the sulfates < 100 ppm. To ensure the below grade environment remains non-aggressive, ground-water chemistry is monitored periodically for the above parameters as part of the Structures Monitoring Program. Therefore, the component or structure will remain capable of performing its intended functions consistent with the current licensing basis for the period of extended operation.

On the basis of its review of current industry research and operating experience, the project team finds that effects of the listed environments on the listed materials will not result in aging that will be of concern during the period of extended operation. Therefore, the project team concludes that there are no applicable aging effects requiring management for the component material and environment described in the preceding discussion.

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

3.3.2.3.2 Auxiliary Systems -- Demineralized Water System – Summary of Aging Management Evaluation – (MNGP LRA Table 3.3.2-5)

The project team reviewed MNGP LRA Table 3.3.2-5 which summarizes the results of AMR evaluations for the Demineralized Water System component group.

In MNGP LRA Table 3.3.2-5, the applicant proposes to manage loss of material due to MIC of copper alloy materials for component types of flow elements, piping and fittings, and valve bodies exposed to treated water environment using MNGP AMP B2.1.25 "Plant Chemistry Program," combined with MNGP AMP B2.1.23 "One-Time Inspection Program."

The project team reviewed the applicant's Plant Chemistry program and the One-Time Inspection program, and its evaluation of each is documented in Sections 2.25 and 2.23 of this audit and review report, respectively. The Plant Chemistry program mitigates the aging effects on component surfaces that are exposed to water as the process fluid; chemistry programs are used to control water chemistry for impurities (e.g., chloride and sulfate) that accelerate corrosion or crack initiation and growth and that cause heat transfer degradation due to fouling in select heat exchangers. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below system-specific limits. The One-Time Inspection Program is a new program consistent with the recommendations of GALL AMP XI.M32, "One-Time Inspection." This program will include measures to verify the effectiveness of the following aging management programs, Plant Chemistry program and the Fuel Oil Chemistry program. This program will also confirm the absence of age degradation in selected components (e.g., flow restrictors, venturis, and small bore piping) within License Renewal scope. The MNGP One-Time Inspection program addresses concerns and confirmation for the potential long incubation period for certain aging effects on structures and components. If system corrosion inhibitor concentrations are maintained within the limits specified by the chemistry program, the corrosion exhibited by the copper alloy in a closed system is adequately managed. The staff has previously accepted that this Aging Effect Requiring Management

(AERM) exists. MNGP has chosen a different combination of AMPs to manage the AERM. The project team review determined that this combination is adequate for managing this material/environment/aging effect and finds it to be acceptable.

In MNGP LRA Table 3.3.2-5, the applicant proposes to manage Loss of Material - Selective Leaching of Copper Alloy materials for component types of Flow Elements, Piping and Fittings, and Valve Bodies exposed to Treated Water (Int.) environment using MNGP AMP B2.1.30, “Selective Leaching of Materials Program.”

The project team reviewed the applicant’s Selective Leaching of Materials program and its evaluation is documented in Section 2.30 of this audit and review report. This is a new program which includes a one-time visual inspection and hardness measurement of selected components that are susceptible to selective leaching. The program will determine if selective leaching is occurring for selected components. The staff has previously accepted the position that this AMP is adequate for managing this material/environment/aging effect.

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 MIC and selective leaching of copper alloy material exposed internally to treated water environment are effectively managed using the Plant Chemistry Program combined with the One-Time Inspection Program and the Selective Leaching of Materials program. On this basis, the project team finds that this is acceptable.

3.3.2.3.3 Auxiliary Systems -- Emergency Diesel Generator System – Summary of Aging Management Evaluation – (MNGP LRA Table 3.3.2-6)

The project team reviewed MNGP LRA Table 3.3.2-6 which summarizes the results of AMR evaluations for the Emergency Diesel Generator System component group.

In MNGP LRA Table 3.3.2-6, the applicant proposes to manage heat transfer degradation - fouling of copper alloy materials for component types of heat exchangers exposed to treated water environment using MNGP AMP B2.1.13, “Closed Cycle Cooling Water.”

In MNGP LRA Table 3.3.2-6, the applicant proposes to manage loss of material due to pitting and crevice corrosion, and MIC of copper alloy materials for component types including gauges (flow, level, and sight), heat exchangers, manifolds, piping and fittings, and valve bodies exposed to treated water environment using MNGP AMP B2.1.13, “Closed Cycle Cooling Water.”

The project team reviewed the applicant’s Closed Cycle Cooling Water program, and its evaluation is documented in Section 2.1.13 of this audit and review report. The Closed-Cycle Cooling Water includes: (1) preventive measures to minimize corrosion, and (2) periodic system and component performance testing and inspection to monitor the effects of corrosion and confirm intended functions are met. Preventive measures include the monitoring and control of corrosion inhibitors and other chemical parameters, such as pH, in accordance with the guidelines of Electric Power Research Institute (EPRI) TR-1007820, Closed Cooling Water Chemistry Guideline vendor recommendations, and plant operating experience. As only minor changes were made to the MNGP Closed-Cycle Cooling Water System Program to implement EPRI TR-1007820, the program is also still in accordance with the EPRI Revision 0 guidelines identified in GALL AMP XI.M21 (i.e., EPRI TR-107396, Closed Cooling Water Chemistry

Guidelines). Periodic inspection and testing to confirm function and monitor corrosion is also performed in accordance with EPRI TR-1007820, vendor recommendations, and industry and plant operating experience. If system corrosion inhibitor concentrations are maintained within the limits specified by the chemistry program, the corrosion exhibited by the copper alloy in a closed system is adequately managed.

In MNGP LRA Table 3.3.2-6, the applicant proposes to manage loss of material due to selective leaching of copper alloy materials for component types of gauges (flow, level, and sight), heat exchangers, and valve bodies exposed to treated water environment using MNGP AMP B2.1.30, “Selective Leaching of Materials.”

The project team reviewed the applicant’s Selective Leaching of Materials program, and its evaluation is documented in Section 2.30 of this audit and review report. This is a new program which includes a one-time visual inspection and hardness measurement of selected components that are susceptible to selective leaching. The program will determine if selective leaching is occurring for selected components.

In MNGP LRA Table 3.3.2-6, the applicant proposes to manage loss of material due to pitting and crevice corrosion, and MIC of copper alloy materials for component types of valve bodies exposed to fuel oil environment using MNGP AMP B2.1.20, “Fuel Oil Chemistry Program.” combined with MNGP AMP B2.1.23 “One-Time Inspection Program.”

In MNGP LRA Table 3.3.2-6, the applicant proposes to manage loss of material due to pitting and crevice corrosion, and MIC of stainless steel materials for component types of manifolds, piping and fittings, and valve bodies exposed to fuel oil environment using MNGP AMP B2.1.20, “Fuel Oil Chemistry Program,” combined with MNGP AMP B2.1.23, “One-Time Inspection Program.”

The project team reviewed the applicant’s Fuel Oil Chemistry program, and its evaluation is documented in Section 2.20 and the One-Time Inspection program and its evaluation is documented in Section 2.23 of this audit and review report. The Fuel Oil Chemistry program is an existing program using existing diesel fuel oil system procedures that encompass the NUREG-1801 program recommendations. The Fuel Oil Chemistry program mitigates and manages aging effects on the internal surfaces of diesel fuel oil storage tanks and associated components in systems that contain diesel fuel oil. The program includes (a) surveillance and monitoring procedures for maintaining diesel fuel oil quality by controlling contaminants in accordance with applicable ASTM Standards; (b) periodic draining of water from diesel fuel oil tanks, if water is present, (c) periodic or conditional visual inspection of internal surfaces or wall thickness measurements (e.g., by UT) from external surfaces of diesel fuel oil tanks; and (d) one-time inspections of a representative sample of components in systems that contain diesel fuel oil.

The applicant’s One-Time Inspection program is a new program consistent with the recommendations of GALL AMP XI.M32, “One-Time Inspection.” This program will include measures to verify the effectiveness of the following aging management programs, Plant Chemistry program and the Fuel Oil Chemistry program. This program will also confirm the absence of age degradation in selected components (e.g., flow restrictors, venturis, and small bore piping) within License Renewal scope. The MNGP One-Time Inspection program addresses concerns and confirmation for the potential long incubation period for certain aging effects on structures and components. The project team review determined that the Fuel Oil

Chemistry program supplemented by the One-Time Inspection program is adequate for managing these material/environment/aging effects.

On the basis of its review of the applicant's plant-specific and industry operating experience, the project team finds the aging effects of Heat Transfer Degradation - Fouling, Loss of Material - Pitting and Crevice Corrosion, and MIC, and Loss of Material - Selective Leaching of Copper Alloy or Stainless Steel materials exposed to Treated Water (Int. Or Ext.) or Fuel Oil environments are effectively managed using Closed Cycle Cooling Water System, Selective Leaching of Materials, or Fuel Oil Chemistry combined with the One-Time Inspection programs. On this basis, the project team finds that management of Heat Transfer Degradation - Fouling in MNGP LRA Table 3.3.2-6 is acceptable.

3.3.2.3.4 Auxiliary Systems -- Emergency Filtration Train System – Summary of Aging Management Evaluation – (MNGP LRA Table 3.3.2-7)

The project team reviewed MNGP LRA Table 3.3.2-7, which summarizes the results of AMR evaluations for the Emergency Filtration Train System component group.

In MNGP LRA Table 3.3.2-7, the applicant proposes to manage Loss of Material - Selective Leaching of Copper Alloy materials for component types of Chillers exposed to Wet Air/Gas (Ext.) environment using MNGP AMP B2.1.30, "Selective Leaching of Materials Program."

The project team reviewed the Selective Leaching of Materials program and its evaluation is documented in Section 2.30 of this audit and review report. This is a new program which includes a one-time visual inspection and hardness measurement of selected components that are susceptible to selective leaching. The program will determine if selective leaching is occurring for 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 loss of material due to selective leaching of copper alloy material exposed externally to wet air/gas environment are effectively managed using selective leaching of materials program. On this basis, the project team finds that management of loss of material due to selective leaching in MNGP LRA Table 3.3.2-7 is acceptable.

3.3.2.3.5 Auxiliary Systems -- Fire System – Summary of Aging Management Evaluation – (MNGP LRA Table 3.3.2-9)

The project team reviewed MNGP LRA Table 3.3.2-9, which summarizes the results of AMR evaluations for the Fire System component group.

In MNGP LRA Table 3.3.2-9, the applicant proposes to manage heat transfer degradation - fouling, loss of material - crevice and pitting corrosion and MIC, and loss of material due to selective leaching of copper alloy materials for component types of heat exchangers exposed to raw water environment using MNGP AMP B2.1.17, "Fire Protection Program."

In MNGP LRA Table 3.3.2-9, the applicant proposes to manage Loss of Material - Crevice and Pitting Corrosion and MIC, and Loss of Material - Selective Leaching of Copper Alloy materials for component types of Heat Exchangers exposed to Glycol Corrosion-Inhibited Treated Water (Ext) environment using MNGP AMP B2.1.17, "Fire Protection Program."

In MNGP LRA Table 3.3.2-9, the applicant proposes to manage Loss of Material - General, Galvanic, Crevice and Pitting Corrosion and MIC, and Loss of Material - Selective Leaching of Gray Cast Iron materials for component types of Heat Exchangers exposed to Glycol Corrosion-Inhibited Treated Water (Int.) environment using MNGP AMP B2.1.17, “Fire Protection Program.”

In MNGP LRA Table 3.3.2-9, the applicant proposes to manage Loss of Material - Galvanic and General Corrosion of Carbon Steel materials for component types of Valve Bodies exposed to Air/Gas (Int.) environment using MNGP AMP B2.1.18, “Fire Water System Program.”

The project team reviewed Fire Protection Program and its evaluation is documented in Section 2.17 of this audit and review report. The Fire Protection program includes a fire barrier inspection program, a diesel-driven fire pump inspection program, and a halon fire suppression system inspection. The program requires periodic visual inspection of fire barriers, seals, walls, ceilings, and floors, and associated fire rated doors. The diesel-driven fire pump inspection program requires that the pump be periodically tested and the diesel engine inspected to ensure that the fuel supply line can perform the intended function. The halon fire-suppression system inspection includes periodic inspection and testing of the cable spreading room halon fire-suppression system. The Fire Protection Program is an existing program. It will be enhanced under parameters monitored or inspected to be consistent, with certain exceptions, with GALL AMP XI.M26, Fire Protection as modified by ISG-04. The exception to GALL Report is the periodic visual inspection and function test of halon systems at least once every six months. The Cable Spreading Room Halon System is functionally tested and visually inspected every 18 months instead of every six months as recommended in NUREG-1801, XI.M26.

With respect to Copper Alloy in Raw Water, the staff has accepted that these AERMs exist in other systems, such as Circulating Water and Diesel Generator support systems. At MNGP, there are also instances of copper alloy in raw water in the Fire Water and Fire Protection systems. MNGP has chosen a different AMP to manage the AERMs. The project team review determined that this AMP is adequate for managing this material/environment/aging effect. With respect to Copper Alloy in Glycol Corrosion-Inhibited Treated Water (Ext), the staff has accepted that these AERMs exist in other systems, such as Circulating Water and Diesel Generator support systems. With respect to Gray Cast Iron in Glycol Corrosion-Inhibited Treated Water (Ext), MNGP has chosen a different AMP to manage the AERMs. The project team reviewed and determined that this AMP is adequate for managing the AERMs of Heat Transfer Degradation - Fouling, Loss of Material - Crevice and Pitting Corrosion and MIC for the materials identified.

The project team review resulted in a Request for Additional Information (RAI) requesting that the applicant demonstrate that the fire water system and the fire protection AMP are adequate for managing Loss of Material - Selective Leaching for these materials.

The project team reviewed the Fire Water System program and its evaluation is documented in Section 2.18 of this audit and review report. The Fire Water System aging management program relies on testing of water-based fire protection system piping and components in accordance with applicable NFPA recommendations. In addition, this program will be modified to include (1) portions of the fire protection sprinkler system that are subjected to full flow tests prior to the period of extended operation and (2) portions of the fire protection system exposed to water that are internally visually inspected. To ensure that the aging mechanisms of corrosion and biofouling/fouling are properly being managed in the Fire Water System, periodic full flow flush test and system performance test are conducted. To ensure that the aging mechanism of selective leaching is properly managed in the Fire Water System, periodic volumetric examinations are combined with visual inspections. The system is also normally maintained at required operating pressure and is monitored such that loss of system pressure is immediately detected and corrective actions initiated. With respect to Carbon Steel in an Air/Gas (Int.) environment, MNGP has chosen, for conservatism, to manage the AERM as though it were a water environment. The project team review determined that this AMP is adequate for managing this material/environment/aging effect.

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 - Fouling, Loss of Material - General, Galvanic, Crevice and Pitting Corrosion and MIC, and Loss of Material - Selective Leaching of Copper Alloy, Gray Cast Iron, and Carbon Steel materials exposed to Raw Water Glycol Corrosion-Inhibited Treated Water (Int. and Ext), and Air/Gas (Int.) environments are effectively managed using Fire Protection and the Fire Water System programs. On this basis, the project team finds that management of Heat Transfer Degradation - Fouling, Loss of Material - General, Galvanic, Crevice and Pitting Corrosion and MIC, in MNGP LRA Table 3.3.2-9 is acceptable. For the Loss of Material - Selective Leaching aging mechanism, the project team has generated a Request for Additional Information (RAI 3.3.2.3.5-1) requesting that the applicant demonstrate that these AMPs are adequate for managing this aging effect/aging mechanism.

3.3.2.3.6 Auxiliary Systems -- Fuel Pool Cooling and Cleanup System – Summary of Aging Management Evaluation – (MNGP LRA Table 3.3.2-10)

The project team reviewed MNGP LRA Table 3.3.2-10 which summarizes the results of AMR evaluations for the Fuel Pool Cooling and Cleanup System component group.

In MNGP LRA Table 3.3.2-10, the applicant proposes to manage loss of material due to crevice and pitting corrosion and MIC of copper alloy materials for component types of piping and fittings, and valve bodies exposed internally to treated water environment using MNGP AMP B2.1.25, "Plant Chemistry Program combined with MNGP AMP B2.1.23 "One-Time Inspection Program."

The project team reviewed the applicant's Plant Chemistry program and the One-Time Inspection program, and its evaluation of each is documented in Sections 2.25 and 2.23 of this audit and review report, respectively. The Plant Chemistry program mitigates the aging effects on component surfaces that are exposed to water as the process fluid; chemistry programs are used to control water chemistry for impurities (e.g., chloride and sulfate) that accelerate corrosion or crack initiation and growth and that cause heat transfer degradation due to fouling in select heat exchangers. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below system-specific limits. The One-Time Inspection program is a new program consistent with the recommendations of GALL AMP XI.M32, "One-Time Inspection." This program will include measures to verify the effectiveness of the following aging management programs, the Plant Chemistry program and the Fuel Oil Chemistry program. This program will also confirm the absence of age degradation in selected components (e.g., flow restrictors, venturis, and small bore piping) within License Renewal scope. The MNGP One-Time Inspection program addresses concerns and confirmation for the potential long incubation period for certain aging effects on structures and components. The staff has accepted that these Aging Effects Requiring Management (AERMs) exists. MNGP has chosen a different combination of AMPs to manage these AERMs. The project team review determined that this combination is adequate for managing this material/environment/aging effect.

In MNGP LRA Table 3.3.2-10, the applicant proposes to manage loss of material due to selective leaching of copper alloy materials for component types of piping and fittings and valve bodies exposed to internally to treated water environment using MNGP AMP B2.1.30, “Selective Leaching of Materials Program.”

The project team reviewed the Selective Leaching of Materials program and its evaluation is documented in Section 2.30 of this audit and review report. This is a new program which includes a one-time visual inspection and hardness measurement of selected components that are susceptible to selective leaching. The program will determine if selective leaching is occurring for selected components.

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 - Crevice and Pitting Corrosion and MIC and Loss of Material - Selective Leaching of Copper Alloy material exposed to Treated Water (Int.) environment are effectively managed using Plant Chemistry combined with One-Time Inspection programs and the Selective Leaching of Materials program. On this basis, the project team finds that management of Loss of Material - Crevice and Pitting Corrosion and MIC and Loss of Material - Selective Leaching in MNGP LRA Table 3.3.2-10 is acceptable.

3.3.2.3.7 <u>Auxiliary Systems -- Heating and Ventilation System – Summary of Aging Management Evaluation – (MNGP LRA Table 3.3.2-11)</u>

The project team reviewed MNGP LRA Table 3.3.2-11, which summarizes the results of AMR evaluations for the Heating and Ventilation System component group.

In MNGP LRA Table 3.3.2-11, the applicant proposes to manage loss of material due to pitting and crevice corrosion of copper alloy materials for component types including heaters/coolers, HVAC units, piping and fittings, and valve bodies exposed to treated water or steam environment using MNGP AMP B2.1.13, “Closed Cycle Cooling Water System Program.”

The project team reviewed Closed Cycle Cooling Water System program, and its evaluation is documented in Section 2.13 of this audit and review report. The Closed-Cycle Cooling Water System program includes: (1) preventive measures to minimize corrosion, and (2) periodic system and component performance testing and inspection to monitor the effects of corrosion and confirm intended functions are met. Preventive measures include the monitoring and control of corrosion inhibitors and other chemical parameters, such as pH, in accordance with the guidelines of Electric Power Research Institute (EPRI) TR-1007820, Closed Cooling Water Chemistry Guideline vendor recommendations, and plant operating experience. As only minor changes were made to the MNGP Closed-Cycle Cooling Water System Program to implement EPRI TR-1007820, the program is also still in accordance with the EPRI Revision 0 guidelines identified in NUREG-1801, Chapter XI, Program M21 (i.e., EPRI TR-107396, Closed Cooling Water Chemistry Guidelines). Periodic inspection and testing to confirm function and monitor corrosion are also performed in accordance with EPRI TR-1007820, vendor recommendations, and industry and plant-operating experience.

In MNGP LRA Table 3.3.2-11, the applicant proposes to manage loss of material due to pitting and crevice corrosion, and MIC of copper alloy materials for component types including gauges (flow, level, and sight), chillers, piping and fittings, and valve bodies exposed to treated water environment using MNGP AMP B2.1.23, "One-Time Inspection Program."

The project team reviewed the One-Time Inspection program, and its evaluation is documented in Section 2.23 of this audit and review report. The One-Time Inspection program is a new program consistent with the recommendations of GALL AMP XI.M32, "One-Time Inspection." This program will include measures to verify the effectiveness of the following aging management programs, Plant Chemistry program and the Fuel Oil Chemistry program. This program will also confirm the absence of age degradation in selected components (e.g., flow restrictors, venturis, and small bore piping) within License Renewal scope. The MNGP One-Time Inspection program addresses concerns and confirmation for the potential long incubation period for certain aging effects on structures and components. The staff has accepted that this Aging Effect Requiring Management (AERM) exists. MNGP has noted in the LRA that In some cases where aging effects/mechanisms are not expected to be significant, the One-Time Inspection alone is credited for managing aging effects. The project team determined that the use of the One-Time Inspection program alone in certain cases, such as no flow conditions, where the use of the Closed Cycle Cooling Water program was not a viable option, was acceptable. The One-Time Inspection program has provisions to increase frequency of inspections based on the results of the first inspection. This aging management program is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects/mechanisms are effectively managed through the period of extended operation.

In MNGP LRA Table 3.3.2-11, the applicant proposes to manage loss of material due to selective leaching of copper alloy materials for component types of chillers, gauges (flow, level, and sight), heaters/coolers, HVAC units, piping and fittings and valve bodies exposed to treated water, Treated Water or Steam (Int.), and Wet Air/Gas (Ext.) environments using MNGP AMP B2.30, "Selective Leaching of Materials Program."

The project team reviewed the Selective Leaching of Materials program, and its evaluation is documented in Section 2.30 of this audit and review report. This is a new program which includes a one-time visual inspection and hardness measurement of selected components that are susceptible to selective leaching. The program will determine if selective leaching is occurring for selected components. The staff has accepted the position that this AMP is adequate for managing this material/environment/aging effect.

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 and Crevice Corrosion and MIC, and Selective Leaching of Copper Alloy material exposed to Treated Water (Int.), Treated Water or Steam (Int.), and Wet Air/Gas (Ext.) environments are effectively managed using the Closed Cycle Cooling Water System, One-Time Inspection, and Selective Leaching of Materials programs. On this basis, the project team finds that management of Loss of Material - Pitting and Crevice Corrosion and MIC, and Selective Leaching in MNGP LRA Table 3.3.2-11 is acceptable.

3.3.2.3.8 Auxiliary Systems -- Instrument and Service Air System – Summary of Aging Management Evaluation – (MNGP LRA Table 3.3.2-12)

The project team reviewed MNGP LRA Table 3.3.2-12, which summarizes the results of AMR evaluations for the Instrument and Service Air System component group.

In MNGP LRA Table 3.3.2-12, the applicant proposes to manage loss of material due to crevice and pitting corrosion, and MIC of copper alloy materials for component types of gauges (flow, level, and sight) and valve bodies exposed to treated water environment using MNGP AMP B2.13, "Closed Cycle Cooling Water System Program."

The project team reviewed Closed Cycle Cooling Water System program, and its evaluation is documented in Section 2.13 of this audit and review report. The Closed-Cycle Cooling Water System program includes: (1) preventive measures to minimize corrosion, and (2) periodic system and component performance testing and inspection to monitor the effects of corrosion and confirm intended functions are met. Preventive measures include the monitoring and control of corrosion inhibitors and other chemical parameters, such as pH, in accordance with the guidelines of Electric Power Research Institute (EPRI) TR-1007820, Closed Cooling Water Chemistry Guideline vendor recommendations, and plant operating experience. As only minor changes were made to the MNGP Closed-Cycle Cooling Water System program to implement EPRI TR-1007820, the program is also still in accordance with the EPRI Revision 0 guidelines identified in NUREG-1801, Chapter XI, Program M21 (i.e., EPRI TR-107396, Closed Cooling Water Chemistry Guidelines). Periodic inspection and testing to confirm function and monitor corrosion is also performed in accordance with EPRI TR-1007820, vendor recommendations, and industry and plant operating experience.

In MNGP LRA Table 3.3.2-12, the applicant proposes to manage loss of material due to crevice and pitting corrosion, and MIC of copper alloy materials for component types of valve bodies exposed to gas - compressed air environment using MNGP AMP B2.14, "Compressed Air Monitoring Program."

The project team reviewed Compressed Air Monitoring program, and its evaluation is documented in Section 2.14 of this audit and review report. The MNGP Compressed Air Monitoring program consists of inspection, monitoring, and testing of the Instrument and Service Air System to provide reasonable assurance that they will perform their intended function for the duration of extended operation. With respect to copper alloy in a gas - compressed air environment, MNGP has chosen, for conservatism, to manage the AERM as though it were an environment with condensation. The project team review determined that this AMP is adequate for managing this material/environment/aging effect

In MNGP LRA Table 3.3.2-12, the applicant proposes to manage loss of material due to selective leaching of copper alloy materials for component types of gauges (flow, level, and sight), and valve bodies exposed to treated water and gas-compressed air environments using MNGP AMP B2.1.30, "Selective Leaching of Materials Program."

The project team reviewed the Selective Leaching of Materials program, and its evaluation is documented in Section 2.30 of this audit and review report. This is a new program which includes a one-time visual inspection and hardness measurement of selected components that are susceptible to selective leaching. The program will determine if selective leaching is occurring for 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 Loss of Material - Crevice and Pitting Corrosion, and MIC and Loss of Material - Selective Leaching of Copper Alloy material exposed to Treated Water (Int.) and Gas - Compressed Air (Int.) environments are effectively managed using Closed Cycle Cooling Water System, Compressed Air Monitoring, and the Selective Leaching of Materials programs. On this basis, the project team finds that management of Loss of Material - Crevice and Pitting Corrosion, and MIC and Loss of Material - Selective Leaching in MNGP LRA Table 3.3.2.-12 is acceptable.

3.3.2.3.9 Auxiliary Systems –Reactor Building Closed Cooling Water System – Summary of Aging Management Evaluation – (MNGP LRA Table 3.3.2-14)

The project team reviewed MNGP LRA Table 3.3.2-14, which summarizes the results of AMR evaluations for the Reactor Building Closed Cooling Water System component group.

In MNGP LRA Table 3.3.2-14, the applicant proposes to manage loss of material due to crevice and pitting corrosion, and MIC of copper alloy materials for component types of piping and fittings and valve bodies exposed to treated water environment using MNGP AMP B2.1.13, "Closed Cycle Cooling Water System Program."

The project team reviewed Closed Cycle Cooling Water System program and its evaluation is documented in Section 2.13 of this audit and review report. The Closed-Cycle Cooling Water System Program includes: (1) preventive measures to minimize corrosion, and (2) periodic system and component performance testing and inspection to monitor the effects of corrosion and confirm intended functions are met. Preventive measures include the monitoring and control of corrosion inhibitors and other chemical parameters, such as pH, in accordance with the guidelines of Electric Power Research Institute (EPRI) TR-1007820, Closed Cooling Water Chemistry Guideline vendor recommendations, and plant operating experience. As only minor changes were made to the MNGP Closed-Cycle Cooling Water System program to implement EPRI TR-1007820, the program is also still in accordance with the EPRI Revision 0 guidelines identified in NUREG-1801, Chapter XI, Program M21 (i.e., EPRI TR-107396, Closed Cooling Water Chemistry Guidelines). Periodic inspection and testing to confirm function and monitor corrosion is also performed in accordance with EPRI TR-1007820, vendor recommendations, and industry and plant operating experience.

In MNGP LRA Table 3.3.2-14, the applicant proposes to manage loss of material due to selective leaching of copper alloy materials for component types of piping and fittings and valve bodies exposed to treated water environment using MNGP AMP B2.1.30, "Selective Leaching of Materials Program."

The project team reviewed the Selective Leaching of Materials program, and its evaluation is documented in Section 2.30 of this audit and review report. This is a new program which includes a one-time visual inspection and hardness measurement of selected components that are susceptible to selective leaching. The program will determine if selective leaching is occurring for 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 Loss of Material - Crevice and Pitting Corrosion, and MIC and Loss of Material - Selective Leaching of Copper Alloy material exposed to Treated Water (Int.) environment are effectively managed using Closed Cycle Cooling Water System and the Selective Leaching of Materials programs. On this basis, the project team finds that management of Loss of Material - Crevice and Pitting Corrosion, and MIC and Loss of Material - Selective Leaching in MNGP LRA Table 3.3.2-14 is acceptable.

3.3.2.3.10 Auxiliary Systems -- Wells and Domestic Water System – Summary of Aging Management Evaluation – (MNGP LRA Table 3.3.2-18)

The project team reviewed MNGP LRA Table 3.3.2-18, which summarizes the results of AMR evaluations for the Wells and Domestic Water System component group.

In MNGP LRA Table 3.3.2-18, the applicant proposes to manage loss of material due to crevice and pitting corrosion, and MIC and loss of material due to erosion of copper alloy materials for component types of piping and fittings and valve bodies exposed to raw water environment using MNGP AMP B2.1.23, "One-Time Inspection Program."

The project team reviewed the One-Time Inspection program, and its evaluation is documented in Section 2.23 of this audit and review report. The One-Time Inspection program is a new program consistent with the recommendations of GALL AMP XI.M32, "One-Time Inspection." This program will include measures to verify the effectiveness of the following aging management programs, the Plant Chemistry program and the Fuel Oil Chemistry program. This program will also confirm the absence of age degradation in selected components (e.g., flow restrictors, venturis, and small bore piping) within License Renewal scope. The MNGP One-Time Inspection program addresses concerns and confirmation for the potential long incubation period for certain aging effects on structures and components. MNGP has noted in the LRA that In some cases where aging effects/mechanisms are not expected to be significant, the One-Time Inspection alone is credited for managing aging effects. The project team determined that the use of the One-Time Inspection program alone in certain cases, such as no flow conditions, where the use of the Plant Chemistry program was not a viable option, was acceptable. The One-Time Inspection program has provisions to increase frequency of inspections based on the results of the first inspection. The staff has accepted that this Aging Effect Requiring Management (AERM) exists. This aging management program is appropriate for the aging effects/mechanisms identified and provides assurance that the aging effects/mechanisms are effectively managed through the period of extended operation.

In MNGP LRA Table 3.3.2-18, the applicant proposes to manage loss of material due to selective leaching of copper alloy materials for component types of piping and fittings and valve bodies exposed to raw water environment using MNGP AMP B2.1.30, "Selective Leaching of Materials Program."

The project team reviewed the Selective Leaching of Materials program, and its evaluation is documented in Section 2.30 of this audit and review report. This is a new program which includes a one-time visual inspection and hardness measurement of selected components that are susceptible to selective leaching. The program will determine if selective leaching is occurring for 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 Loss of Material - Crevice and Pitting Corrosion, and MIC, Loss of Material - Erosion and Loss of Material - Selective Leaching of Copper Alloy material exposed to Raw Water (Int.) environment are effectively managed using the One-Time Inspection and the Selective Leaching of Materials programs. On this basis, the project team finds that management of Loss of Material - Crevice and Pitting Corrosion, and MIC, Loss of

Material - Erosion and Loss of Material - Selective Leaching in MNGP LRA Table 3.3.2-18 is acceptable.

3.3.3 Conclusion

On the basis of its audit for component groups for which the AMR results are not consistent with the GALL Report or not addressed in the GALL Report, the project team determines that (1) the aging management review results documented by the applicant in the LRA are reasonable and are technically justified and (2) the applicant adequately addressed the aging management issues that were evaluated. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

On the basis of its review, the project team concludes that the applicant has demonstrated that the aging effects associated with the auxiliary system components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3).

The project team also reviewed the applicable FSAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the auxiliary systems, as required by 10 CFR 54.21(d).

3.4 MNGP LRA Section 3.4 - Aging Management of Steam and Power Conversion System

3.4.1 Summary of Technical Information in the LRA

In the MNGP LRA, Section 3.4, the applicant provided the results of its aging management reviews (AMR's) for the steam and power conversion system.

In the MNGP LRA, Tables 3.4.2-1 through 3.4.2-5, the applicant provided a summary of the AMR's for components/commodities in the (1) condensate storage, (2) condensate and feedwater, (3) main condenser, (4) main steam, and (5) turbine generator systems.

The summary information for each component type included intended function; material; environment; aging effect requiring management; AMP's; the GALL Report Volume 2 item; cross reference to the MNGP LRA Table 3.4.1 (Table 1); and generic and plant-specific notes related to consistency with the GALL Report.

Also, the applicant identified for each component type in the MNGP LRA, Table 3.4.1, those components that are consistent with the GALL Report, those that are consistent with the GALL Report for which further evaluation is recommended, and those that are not consistent or are not addressed in the GALL Report, together with the basis of their exclusion.

3.4.2 Project Team Evaluation

The project team conducted its audit and review in accordance with SRP-LR Section 3.4.3 and the MNGP audit and review plan. The project team interviewed the applicant's technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report.

Table 3.4-1 presents the project team evaluation for steam and power conversion system components in the GALL Report.

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

For AMR's that the applicant stated are consistent with the GALL Report, the project team conducted its audit and review to determine whether the applicant's references to the GALL Report in the MNGP LRA are acceptable.

The project team reviewed its assigned MNGP 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 components that are subject to an AMR.

**Table 3.4-1 Project Team Evaluation for Steam and Power Conversion System Components in the GALL Report**

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Piping and fittings in main feedwater line, steam line, and auxiliary feedwater (AFW) piping (PWR only)<br>(Item Number 3.4.1-01) | Cumulative fatigue damage | TLAA, evaluated in accordance with 10 CFR 54.21(c) | TLAA | See Section 3.4.2.2.1 |
| Piping and fittings, valve bodies and bonnets, pump casings, tanks, tubes, tubesheets, channel head, and shell (except main steam system) (Item Number 3.4.1-02) | Loss of material due to general (carbon steel only), pitting, and crevice corrosion | Water chemistry and one-time inspection | Plant chemistry program (B2.1.25); One-time inspection (B2.1.23) | Consistent with the GALL Report, which recommends further evaluation (See Section 3.4.2.2.2) |
| 3.4.1-03 | PWR Only | | | |
| 3.4.1-04 | PWR Only | | | |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| External surface of carbon steel components (Item Number 3.4.1-05) | Loss of material due to general corrosion | Plant specific | System condition monitoring program (B2.1.32) | Consistent with the GALL Report, which recommends further evaluation (See Section 3.4.2.2.3) |
| Carbon steel piping and valve bodies (Item Number 3.4.1-06) | Wall-thinning due to Flow accelerated corrosion | Flow-accelerated corrosion | Flow-accelerated corrosion (B2.1.19) | Consistent with the GALL Report |
| Carbon steel piping and valve bodies in main steam system (Item Number 3.4.1-07) | Loss of material due to pitting and crevice corrosion | Water chemistry | Plant chemistry program (B2.1.25); One-time inspection (B2.1.23) | Consistent with the GALL Report |
| Closure bolting in high-pressure or high-temperature systems (Item Number 3.4.1-08) | Loss of material due to general corrosion; crack initiation and growth due to cyclic loading and/or SCC | Bolting integrity | Bolting integrity (B2.1.4) | Consistent with the GALL Report |
| Heat exchangers and coolers/ condensers by open-cycle cooling water (Item Number 3.4.1-09) | Loss of material due to general (carbon steel only), pitting, and crevice corrosion, MIC and biofouling; buildup of deposit due to biofouling | Open-cycle cooling water system | Not applicable. | For further discussion, see Section 3.4.2.1.1. |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Heat exchangers and coolers/ condensers by closed-cycle cooling water (Item Number 3.4.1-10) | Loss of material due to general (carbon steel only), pitting, and crevice corrosion | Closed-cycle cooling water system | Not applicable. MNGP main condenser structural integrity is demonstrated during normal plant operation. | For further discussion, see Section 3.4.2.1.2. |
| External surface of above-ground condensate storage tank (Item Number 3.4.1-11) | Loss of material due to general (carbon steel only), pitting, and crevice corrosion | Above-ground carbon steel tanks | Not applicable. MNGP condensate storage tanks are not within the scope of license renewal. | For further discussion, see Section 3.4.2.1.3. |
| External surface of buried condensate storage tank and AFW piping (Item Number 3.4.1-12) | Loss of material due to general, pitting, and crevice corrosion, and MIC | Buried piping and tanks surveillance<br><br>or<br><br>Buried piping and tanks inspection | Not applicable. MNGP has no buried condensate storage tanks or AFW piping. | For further discussion, see Section 3.4.2.2.4. |
| 3.4.1-13 | PWR Only | | | |

The following sections identify those line items where the project team found a difference between the GALL Report and the MNGP LRA.

3.4.2.1.1 Loss of Material Due to General, Pitting, and Crevice Corrosion, MIC and Biofouling; Buildup of Deposit due to Biofouling

In MNGP LRA Table 3.4.1, Item Number 3.4.1-09 the applicant addresses the loss of material due to general corrosion, pitting, and crevice corrosion, MIC and biofouling, and buildup of deposit due to biofouling for heat exchangers and coolers/condensers that are serviced by open-cycle cooling water. The applicant states that Item Number 3.4.1-09 is not applicable to MNGP. The applicant states that the management of aging effects associated with certain components of the main condenser with the intended function of plateout and holdup of radioactive material is not applicable because the main condenser structural integrity is continuously demonstrated during normal plant operation.

During the audit and review, the project team noted that, in MNGP LRA Table 3.4.2-3, the applicant presents its AMR results for the main condenser system. Under the table subheading "Main Condenser", on page 3-548 of the MNGP LRA, the applicant claimed consistency with the GALL Report for aging management of the internal and external surfaces of the carbon steel condenser shell. Generic Note E was cited (i.e., the component, material, and environment are consistent with the recommendation of the GALL Report, but a different AMP is applied by the applicant). However, the applicant claimed that an AMP was not applicable, and referenced plant-specific Note 410. The project team questioned the applicant's use of Note E for these AMR entries, as no AMP was credited.

In response, the applicant states that the structural integrity of the main condenser that is required to perform its post-accident intended function is continuously demonstrated during normal plant operation; therefore, no traditional aging management program is required. The post-accident intended function of the main condensers is to provide a holdup volume and plateout surface for MSIV leakage. This intended function does not require the main condensers to be leak-tight, since the post-accident conditions in the main condensers are essentially atmospheric. Under post-accident conditions, there will be no challenge to the pressure boundary integrity of the main condensers. Since normal plant operation assures adequate main condenser pressure boundary integrity, the post-accident intended function to provide pressure boundary and holdup volume and plateout surface is assured.

The project team noted that SRP-LR Appendix A, Section A.1.2.3.4, stated that a program based solely on detecting structure and component failures is not considered an effective aging management program. The project team then evaluated the applicant's justification and requested that the applicant clarify why it provided no aging management program for these components.

The applicant stated that radioactive iodine is assumed to plate out on the interior surfaces of the main condenser for both a loss of coolant accident and a control rod drop accident. Aging management is not required for the main condenser components that have only a plateout and holdup of radioactive material intended function. For these components, the aging effects do not require aging management, as the deposition of iodine in the main condenser is unaffected by the condenser surface condition. To maintain the intended function, the main condenser and the components, which make up the main condenser complex, simply have to remain intact. Condenser structural integrity is continuously demonstrated during normal operation when the condenser is required to maintain vacuum. When the condenser is required to perform its intended function, following a design basis accident, the main steam isolation valves will be closed and condenser vacuum will be lost. The condenser will not be required to perform a pressure boundary function because essentially atmospheric conditions will exist inside the condenser. Since normal performance considerations, such as fouling and in-leakage (e.g., circulating water or air leaks), place greater requirements on condenser operation than the post-accident plateout, then, as long as the condenser is intact and operational, the post-accident plateout and holdup of radioactive material intended function will be maintained and no aging management is required.

Additionally, as documented in the applicant's letter dated August 31, 2005 (ML052500294), the applicant revised plant-specific Note 410 to clarify the discussion of the intended function of the main condenser; it reads as follows.

No traditional aging management of the main condenser for plateout and holdup is required. The main condenser is required to perform a post-accident intended function of plateout and holdup. This post-accident intended function does not require the main condenser to be leak tight and post-accident conditions in the main condenser would be essentially atmospheric. During normal plant operation, the main condenser continuously verifies its structural integrity by maintaining condenser vacuum that is constantly monitored and provides assurance that it will perform its post-accident intended function of iodine plateout and holdup.

The project team reviewed the applicant’s response and finds that the main condenser does not have to be leak-tight, as the post-accident conditions in the main condenser are essentially atmospheric. During normal plant operations, condenser vacuum is continuously monitored, which verifies the integrity of the main condenser. If the integrity of the main condenser were to degrade to a point where a loss of vacuum occurred, this would require placing the plant in a mode where the post-accident intended function would be obviated. Therefore, acceptable performance during normal plant operation provides adequate assurance that the main condenser can perform the holdup and plateout post-accident function.

On this basis, the project team found that the applicant appropriately addressed the aging effect/mechanism, as identified in 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 AMRs results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the project team 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).

#### 3.4.2.2 Aging Management Review Results For Which Further Evaluation Is Recommended

For some line items assigned to the project team in MNGP LRA Tables 3.4.2-1 through 3.4.2-5, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in MNGP LRA Section 3.4.2.2 against the criteria provided in the SRP-LR Section 3.4.2.2. The project team’s assessments of these evaluations is documented in this section. These assessments are applicable to each Table 2 line-item in Section 3.4 citing the item in Table 3.4.1 for which further evaluation is recommended.

##### 3.4.2.2.1 Cumulative Fatigue Damage

Cumulative fatigue is a TLAA, as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The evaluation of this TLAA is performed by NRR DE staff and addressed in Section 4 of the SER related to the MNGP LRA.

##### 3.4.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

The project team reviewed MNGP LRA Section 3.4.2.2.2 against the criteria in SRP-LR Section 3.4.2.2.2, which states the following:

> The management of loss of material due to general, pitting, and crevice corrosion should be evaluated further for carbon steel piping and fittings, valve bodies and bonnets, pump casings, pump suction and discharge lines, tanks, tubesheets, channel heads, and shells except for main steam system components and for loss of material due to pitting and crevice corrosion for stainless steel tanks and heat exchanger/cooler tubes. The water chemistry program relies on monitoring and control of water chemistry based on the guidelines in EPRI guideline TR-102134 for secondary water chemistry to manage the effects of loss of material due to general, pitting, or crevice corrosion. However, corrosion may occur at locations of stagnant flow conditions. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In MNGP LRA, Section 3.4.2.2.2, the applicant states the following.

> This subsection discusses loss of material due to general, pitting and crevice corrosion of carbon steel and cast iron 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, in the steam and power conversion system. This subsection also discusses loss of material due to pitting and crevice corrosion of stainless steel components in the steam and power conversion system. Aging effect is managed by the One-Time Inspection Program and Plant Chemistry Program. Exceptions apply to NUREG-1801 recommendations for the Plant Chemistry Program implementation (refer to Appendix B, Section B2.1.25). The One-Time Inspection Program is a new AMP. The scope of this new AMP is to include activities to verify the effectiveness of the Plant Chemistry Program, including a sample of components where the flow of water is low or stagnant conditions exist (refer to Appendix B, Section B2.1.23). Implementation of the One-Time Inspection Program, in conjunction with the Plant Chemistry Program, to manage the aging effect provides added assurance that the aging effect is not occurring at locations of stagnant or low flow; or that the aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

The applicant states in the MNGP LRA that the loss of material for carbon and stainless steel components in steam and power conversion systems is managed by the plant chemistry program, MNGP AMP B2.25, and that, to verify the efficacy of that program, a one-time inspection of selected components and susceptible locations will be performed. The project team's evaluation of the “Plant Chemistry” and “One-Time Inspection” programs is documented in Sections 2.25 and 2.23, respectively, of this audit and review report. The project team finds that, based on the application of these two programs, 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.

On the basis of its review, the project team finds that the applicant addressed the aging effect/mechanism, as identified in the GALL Report.

3.4.2.2.3 <u>General Corrosion</u>

The project team reviewed MNGP LRA, Section 3.4.2.2.4, against the criteria in SRP-LR, Section 3.4.2.2.4, which states the following.

> Loss of material due to general corrosion could occur on the external surfaces of all carbon steel strictures and components, including closure bolting, exposed to operating temperature less that 212°F. The GALL Report recommends further evaluation to ensure that this aging effect is adequately managed.

In MNGP LRA Section 3.4.2.2.4, the applicant states the following:

> This subsection discusses loss of material due to general corrosion on the external surfaces of carbon steel and cast iron components of the steam and power conversion system in air/gas environments. Aging effect is managed by the System Condition Monitoring Program. The System Condition Monitoring Program is used to manage the aging effect on the external surfaces of carbon steel and cast iron components in air/gas environments. Management of the aging effect associated with certain components of the Main Condenser with the intended function, “plateout and holdup of radioactive material,” is not applicable since the Main Condenser structural integrity is continuously demonstrated during normal plant operation. The System Condition Monitoring Program is a new plant-specific program. This program manages aging effects for normally accessible, external surfaces of piping, tanks, and other components and equipment within the scope of License Renewal. These aging effects are managed through visual inspection and monitoring of external surfaces for leakage and evidence of material degradation (refer to Appendix B, Section B2.1.32). Implementation of the System Condition Monitoring Program to manage corrosion provides added assurance that corrosion is not occurring; or that the aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

The applicant states in the MNGP LRA that the loss of material for carbon steel and cast iron components in steam and power conversion systems is managed by the System Condition Monitoring program, MNGP AMP 2.32. Management of the aging effects associated with the main condensers is not applicable, as the pressure boundary integrity of these components is continuously confirmed through normal plant operations. As documented in the applicant’s letter dated August 31, 2005 (ML052500294), the applicant states that it will revise the MNGP LRA to eliminate reference to the pressure boundary function of the main condensers, as this function is inappropriate for these components.

The project team reviewed the applicant’s system condition monitoring program, and its evaluation is documented in Section 2.32 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 3.4.2.2.4 for further evaluation.

On the basis of its review, the project team finds that the applicant addressed the aging effect/mechanism, as identified in the GALL Report.

3.4.2.2.4 Loss of Material due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

The applicant stated, in MNGP LRA, Section 3.4.2.2.5.2, that MNGP condensate storage tanks are not safety-related; therefore, they are not within the scope of licensing renewal. The applicant also stated, in MNGP LRA, Section 3.4.2.2.5.2, that these condensate storage tanks are above ground. There are no underground condensate storage tanks at MNGP.

On the basis that MNGP does not have any components from this group, the project team concurred with the applicant's determination that this aging effect is not applicable to MNGP.

Conclusion. On the basis of its audit and review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the project team determined that (1) those attributes or features for which the applicant claimed consistency with the GALL Report were indeed consistent and (2) the applicant adequately addressed the issues that were further evaluated. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3 Aging Management Review Results That Are Not Consistent with the GALL Report or Not Addressed in the GALL Report

In MNGP LRA, Tables 3.4.2-1 through 3.4.2-5, 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.

3.4.2.3.1 AMR Results Where No Aging Effects Were Identified (MNGP LRA Tables 3.4.2-1 through 3.4.2-5)

In MNGP LRA, Tables 3.4.2-1 through 3.4.2-5, the applicant identified AMR results line-items where no aging effects were identified as a result of the aging review process. Specifically, instances in which the applicant stated that no aging effects were identified occurred when components fabricated from stainless steel and rubber materials were exposed to a primary containment air, plant indoor air environment, instrument air, or gas environment, or when components fabricated from carbon steel or stainless steel were exposed to a lubricating oil environment. The applicant states that a material science evaluation for these materials in these environments results in no aging effects.

On the basis that stainless steels are highly resistant to corrosion in dry atmospheres, in the absence of corrosive species, as cited in Metals Handbook, Ninth Edition, American Society for Metals International, the staff has accepted the position that stainless steel in an indoor, uncontrolled air environment (e.g., plant indoor air) or in a gas environment (e.g., primary containment air inerted with nitrogen) exhibits no aging effect, and the position that the component or structure will therefore remain capable of performing its intended functions consistent with the current licensing basis for the period of extended operation. Also, on the basis that both oxygen and moisture must be present to corrode steel, as cited in Metals Handbook, the staff has also accepted the position that carbon steel or stainless steel, in a lubricating oil internal environment with no water pooling, exhibits no aging effect, and that the component or structure will therefore remain capable of performing its intended functions consistent with the current licensing basis for the period of extended operation. As listed in the GALL Report, rubber that is not in an environment of elevated temperature (i.e., over about 95°F [35°C]) with additional factors, such as exposure to ozone, oxidation, and radiation, will therefore remain capable of performing its intended functions consistent with the current licensing basis for the period of extended operation.

On the basis of its review of current industry research and operating experience, the project team finds that plant indoor air, primary containment air, or instrument air on stainless steel or rubber, or lubricating oil on stainless steel or carbon steel, will not result in aging that will be of concern during the period of extended operation. Therefore, the project team concludes that there are no applicable aging effects requiring management for the component material and environment described in the preceding discussion.

On the basis of the project team audit and review of the MNGP LRA, the GALL Report and technical references for these materials and environments, the project team finds that the applicant has demonstrated that no aging effects are predicted for the material and environmental combinations reported and that the steam and power conversion system components fabricated from these materials in the environments listed above will perform their intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3.2 Steam and Power Conversion System - Condensate Storage System - Summary of Aging Management Evaluation - (MNGP LRA Table 3.4.2-1)

The project team reviewed MNGP LRA Table 3.4.2-1, which summarizes the results of AMR evaluations for the condensate storage system component groups. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.3 Steam and Power Conversion System - Condensate and Feedwater System – Summary of Aging Management Evaluation – (MNGP LRA Table 3.4.2-2)

The project team reviewed MNGP LRA Table 3.4.2-2, which summarized the results of AMR evaluations for the Condensate and Feedwater System component group.

In MNGP LRA Table 3.4.2-2, the applicant proposes to manage cracking and change in material properties due to thermal exposure of rubber materials for component types of expansion joints exposed to a treated water, internal, environment using MNGP AMP B2.1.23, “One-Time Inspection Program.”

The project team reviewed the applicant’s One-Time Inspection program and its evaluation is documented in Section 2.23 of this audit and review report. 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 cracking due to thermal exposure of rubber material exposed to a treated water, internal, environment is effectively managed using the One-Time Inspection program. On this basis, the project team finds that management of cracking due to thermal exposure in Condensate and Feedwater System is acceptable.

3.4.2.3.4 Steam and Power Conversion System - Main Condenser System - Summary of Aging Management Evaluation - (MNGP LRA Table 3.4.2-3)

The project team reviewed MNGP LRA Table 3.4.2-3, which summarizes the results of AMR evaluations for the main condenser system component groups. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.5 Steam and Power Conversion System - Main Steam System - Summary of Aging Management Evaluation - (MNGP LRA Table 3.4.2-4)

The project team reviewed MNGP LRA Table 3.4.2-4, which summarizes the results of AMR evaluations for the main steam system component groups. The results of these evaluations are all consistent with the GALL Report.

3.4.2.3.6 Steam and Power Conversion System - Turbine Generator System – Summary of Aging Management Evaluation – (MNGP LRA Table 3.4.2-5)

The project team reviewed MNGP LRA Table 3.4.2-5, which summarized the results of AMR evaluations for the Turbine Generator System component group.

In MNGP LRA Table 3.4.2-5, the applicant proposes to manage the loss of material due to selective leaching of cast iron materials for component types of steam traps exposed to a treated water or steam, internal, environment using MNGP AMP B.2.1.30, “Selective Leaching of Materials.”

The project team reviewed the applicant’s Selective Leaching of Materials program and its evaluation is documented in Section 2.30 of this audit and review report. The selective leaching of materials program includes a one-time visual inspection and hardness measurement of selected components that are susceptible to selective leaching. In situations where hardness testing is not practical, a qualitative method by other NDE or metallurgical methods will be used to determine the presence and extent of selective leaching. The program will determine if selective leaching is occurring for selected components. This program will ensure the integrity of components made of gray cast iron, bronze, brass, and other alloys exposed to a raw water, treated water, or ground-water environment that may lead to selective leaching of one of the metal components.

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 the loss of material due to selective leaching of cast iron material exposed to a treated water or steam, internal, environment is effectively managed using Selective Leaching of Materials program. On this basis, the project team finds that management of the loss of material due to selective leaching in the Turbine Generator System is acceptable.

In MNGP LRA Table 3.4.2-5, the applicant proposes to manage the loss of material due to crevice corrosion of copper alloy materials for component types of gauges internally exposed to a treated water environment using MNGP AMP B2.1.23, “One-Time Inspection,” and MNGP AMP B2.1.25, “Plant Chemistry.”

The project team reviewed the applicant’s One-Time Inspection program, and its evaluation is documented in Section 2.23 of this audit and review report. The project team reviewed the applicant’s Plant Chemistry program, and its evaluation is documented in Section 2.25 of this audit and review report. 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 the loss of material due to crevice corrosion of copper alloy material exposed to a treated water, internal, environment is effectively managed using the Plant Chemistry and the One-Time Inspection programs. On this basis, the project team finds that management of the loss of material due to crevice corrosion in the Turbine Generator System is acceptable.

In MNGP LRA Table 3.4.2-5, the applicant proposed to manage the loss of material due to MIC of copper alloy materials for component types of gauges exposed to a treated water, internal, environment using MNGP AMP B2.1.23, “One-Time Inspection.”

The project team reviewed the applicant’s One-Time Inspection program and its evaluation is documented in Section 2.23 of this audit and review report. 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 the loss of material due to MIC of copper alloy material exposed to a treated water, internal, environment is effectively managed using the One-Time Inspection program. On this basis, the project team finds that management of the loss of material due to MIC in the Turbine Generator System is acceptable.

In MNGP LRA Table 3.4.2-5, the applicant proposed to manage the loss of material due to pitting corrosion of copper alloy materials for component types of gauges exposed to a treated water, internal, environment using MNGP AMP B2.1.23, “One-Time Inspection,” and MNGP AMP B2.1.25, “Plant Chemistry.”

The project team reviewed the applicant’s Plant Chemistry program, and its evaluation is documented in Section 2.25 of this audit and review report. The project team reviewed the applicant’s One-Time Inspection program, and its evaluation is documented in Section 2.23 of this audit and review report. 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 the loss of material due to pitting corrosion of copper alloy material exposed to a treated water, internal, environment is effectively managed using the Plant Chemistry and the One-Time Inspection programs. On this basis, the project team finds that management of the loss of material due to pitting corrosion in the Turbine Generator System is acceptable.

In MNGP LRA Table 3.4.2-5, the applicant proposes to manage loss of material due to MIC of copper alloy materials for component types of gauges exposed to a treated water, internal, environment using MNGP AMP B2.1.25, “Plant Chemistry.”

The project team reviewed the applicant’s Plant Chemistry program, and its evaluation is documented in Section 2.25 of this audit and review report. 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 the loss of material due to MIC of copper alloy material exposed to a treated water environment is effectively managed using the Plant Chemistry program. On this basis, the project team finds that management of the loss of material due to MIC in the Turbine Generator System is acceptable.

In MNGP LRA Table 3.4.2-5, the applicant proposes to manage the loss of material due to selective leaching of copper alloy materials for component types of heat exchangers exposed to a wet air or gas environment using MNGP AMP B2.1.30, "Selective Leaching of Materials."

The project team reviewed the applicant's Selective Leaching of Materials program and its evaluation is documented in Section 2.30 of this audit and review report. 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 the selective leaching of materials of copper alloy material exposed to a wet air or gas environment is effectively managed using the Selective Leaching of Materials program. On this basis, the project team finds that management of the selective leaching of materials in the Turbine Generator System is acceptable.

In MNGP LRA Table 3.4.2-5, the applicant proposes to manage loss of material due to crevice corrosion of copper alloy materials for component types of heat exchangers externally exposed to a wet air or gas environment using MNGP AMP B2.1.32, "System Condition Monitoring Program."

The project team reviewed the applicant's System Condition Monitoring program and its evaluation is documented in Section 2.32 of this audit and review report. 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 the loss of material due to crevice corrosion of copper alloy material exposed to a wet air or gas environment is effectively managed using the System Condition Monitoring program. On this basis, the project team finds that management of the loss of material due to crevice corrosion in the Turbine Generator System is acceptable.

In MNGP LRA Table 3.4.2-5, the applicant proposes to manage the loss of material due to MIC of copper alloy materials for component types of heat exchangers exposed to a wet air or gas, external, environment using MNGP AMP B2.1.32, "System Condition Monitoring Program."

The project team reviewed the applicant's System Condition Monitoring program, and its evaluation is documented in Section 2.32 of this audit and review report. 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 the loss of material due to MIC of copper alloy material exposed to a wet air or gas environment is effectively managed using the System Condition Monitoring program. On this basis, the project team finds that management of the loss of material due to MIC in the Turbine Generator System is acceptable.

In MNGP LRA Table 3.4.2-5, the applicant proposes to manage the loss of material due to pitting corrosion of copper alloy materials for component types of heat exchangers exposed to a wet air or gas, external, environment using MNGP AMP B2.1.32, "System Condition Monitoring Program."

The project team reviewed the applicant's System Condition Monitoring program, and its evaluation is documented in Section 2.32 of this audit and review report. 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 the loss of material due to pitting corrosion of copper alloy material exposed to a wet air or gas environment is effectively managed using the System Condition

Monitoring program.  On this basis, the project team finds that management of the loss of material due to pitting corrosion in the Turbine Generator System is acceptable.

### 3.4.3 Conclusion

On the basis of its review, the project team concludes that the applicant has demonstrated that the aging effects associated with the steam and power conversion system components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3).

The project team also reviewed the applicable USAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the steam and power conversion systems, as required by 10 CFR 54.21(d).

## 3.5 MNGP LRA Section 3.5 - Aging Management of Containments, Structures, and Component Supports

### 3.5.1 Summary of Technical Information in the LRA

In the MNGP LRA Section 3.5, the applicant provided the results of its AMRs for the containment, structures, and component supports.  In the MNGP LRA Tables 3.5.2-1 through 3.5.2-18, the applicant provided a summary of the AMRs results for components/commodities associated with (1) cranes, heavy loads, rigging, (2) diesel fuel oil transfer house, (3) emergency diesel generator building, (4) emergency filtration train building, (5) fire protection barriers commodity group, (6) hangers and support commodity group, (7) HPCI building, (8) intake structure, (9) miscellaneous SBO yard structures, (10) off gas stack, (11) off gas storage and compressor building, (12) plant control and cable spreading structure, (13) primary containment, (14) radioactive waste building, (15) reactor building, (16) structures affecting safety, (17) turbine building, and (18) underground duct bank.  The summary information for each component type included intended function; material; environment; aging effect requiring management; AMPs; the GALL Report Volume 2 item; cross reference to the MNGP LRA Table 3.5.1 (Table 1); and generic and plant-specific notes related to consistency with the GALL Report.

Also, the applicant identified for each component type in the MNGP LRA Table 3.5.1 those components that are consistent with the GALL Report, those components that are consistent with the GALL Report in which further evaluation is recommended, and those components that are not addressed in the GALL Report together with the basis of their exclusion.

### 3.5.2 Project Team Evaluation

The project team conducted its audit in accordance with SRP-LR Section 3.5 and the MNGP audit and review plan. The project team interviewed the applicant’s technical staff and reviewed, in whole or in part, the documents listed in Attachment 5 of this report.

Table 3.5-1 presents the project team evaluation for containments, structures, and component supports in the GALL Report.

#### 3.5.2.1 Aging Management Review Results That Are Consistent with the GALL Report

For AMRs that the applicant states are consistent with the GALL Report, the project team conducted its audit to determine if the applicant's references to the GALL Report in the LRA are acceptable.

The project team reviewed its assigned 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 components that are subject to an AMR.

**Table 3.5-1 Project Team Evaluation for Containments, Structures and Component Supports in the GALL Report**

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Penetration sleeves, penetration bellows, and dissimilar metal welds (Item Number 3.5.1-01) | Cumulative fatigue damage (CLB fatigue analysis exists for some components) | TLAA evaluated in accordance with 10 CFR 54.21(c) | TLAA | This TLAA is evaluated in Section 4.6. (See Section 3.5.2.2.1.6) |
| Penetration sleeves, bellows, and dissimilar metal welds (Item Number 3.5.1-02) | Cracking due to cyclic loading; crack initiation and growth due to SCC | Containment inservice inspection (ISI) and Containment leak rate test | Primary Containment Inservice Inspection Program (B2.1.26); 10 CFR part 50, Appendix J program (B2.1.1) | Consistent with GALL Report with acceptable exceptions in B2.1.1, which recommends further evaluation (See Section 3.5.2.2.1.7) |
| Penetration sleeves, bellows, and dissimilar metal welds (Item Number 3.5.1-03) | Loss of material due to corrosion | Containment ISI and Containment leak rate test | Primary Containment Inservice Inspection Program (B2.1.26); 10 CFR part 50, Appendix J program (B2.1.1) | Consistent with GALL Report with acceptable exceptions in B2.1.1 (See Section 3.5.2.1) |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Personnel airlock and equipment hatch (Item Number 3.5.1-04) | Loss of material due to corrosion | Containment ISI and Containment leak rate test | Primary Containment Inservice Inspection Program (B2.1.26); 10 CFR part 50, Appendix J program (B2.1.1) | Consistent with GALL Report with acceptable exceptions in B2.1.1 (See Section 3.5.2.1) |
| Personnel airlock and equipment hatch (Item Number 3.5.1-05) | Loss of leak tightness in closed position due to mechanical wear of locks, hinges, and closure mechanisms | Containment leak rate test and Plant Technical Specifications | 10 CFR part 50, Appendix J program (B2.1.1) | Consistent with GALL Report with acceptable exceptions in B2.1.1 (See Section 3.5.2.1) |
| Seal, gaskets, and moisture barriers (Item Number 3.5.1-06) | Loss of sealant and leakage through containment due to deterioration of joint seals, gaskets, and moisture barriers | Containment ISI and Containment leak rate test | Primary Containment Inservice Inspection Program (B2.1.26); 10 CFR part 50, Appendix J program (B2.1.1) | Consistent with GALL Report with acceptable exceptions in B2.1.1 (See Section 3.5.2.1) |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Concrete elements: foundation, dome, and wall (Item Number 3.5.1-07) | Aging of accessible and inaccessible concrete areas due to leaching of calcium hydroxide, aggressive chemical attack, and corrosion of embedded steel | Containment ISI | Not applicable to MNGP Mark I Containment | Not applicable to MNGP Mark I Containment |
| Concrete elements: foundation (Item Number 3.5.1-08) | Cracks, distortion, and increases in component stress level due to settlement | Structures Monitoring | Not applicable to MNGP Mark I Containment | Not applicable to MNGP Mark I Containment |
| Concrete elements: foundation (Item Number 3.5.1-09) | Reduction in foundation strength due to erosion of porous concrete subfoundation | Structures Monitoring | Not applicable to MNGP Mark I Containment | Not applicable to MNGP Mark I Containment |
| Concrete elements: foundation, dome, and wall (Item Number 3.5.1-10) | Reduction of strength and modulus due to elevated temperature | Plant specific | Not applicable to MNGP Mark I Containment | Not applicable to MNGP Mark I Containment |
| Prestressed containment: tendons and anchorage components (Item Number 3.5.1-11) | Loss of prestress due to relaxation, shrinkage, creep, and elevated temperature | TLAA evaluated in accordance with 10 CFR 54.21(c) | Not applicable to MNGP Mark I Containment | Not applicable to MNGP Mark I Containment |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Steel element: liner plate and containment shell (Item Number 3.5.1-12) | Loss of material due to corrosion in accessible and inaccessible areas | Containment ISI and Containment leak rate test | Primary Containment Inservice Inspection Program (B2.1.26); 10 CFR part 50, Appendix J program (B2.1.1) | Consistent with GALL Report with acceptable exceptions in B2.1.1, which recommends further evaluation (See section 3.5.2.2.1.4) |
| Steel elements: vent header, drywell head, torus, downcomers, and pool shell (Item Number 3.5.1-13 | Cumulative fatigue damage (CLB fatigue analysis exists) | TLAA evaluated in accordance with 10 CFR 54.21(c) | TLAA | This TLAA is evaluated in Sections 4.3 and 4.6 (See section 3.5.2.2.1.6) |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Steel elements: protected by coating (Item Number 3.5.1-14) | Loss of material due to corrosion in accessible areas only | Protective coating monitoring and maintenance | Primary Containment Inservice Inspection Program (B2.1.26); 10 CFR part 50, Appendix J program (B2.1.1). | Protective coating monitoring program is not relied upon for managing loss of material due to corrosion. The Primary Containment Inservice Inspection Program (B2.1.26) and the 10 CFR 50, Appendix J Program (B2.1.1) with acceptable exceptions are credited with managing this aging effect. Consistent with GALL Report. However, a different AMP is credited. |
| Prestressed containment: tendons and anchorage components (Item Number 3.5.1-15) | Loss of material due to corrosion of prestressing tendons and anchorage components | Containment ISI | Not applicable to MNGP Mark I Containment | Not applicable to MNGP Mark I Containment. There are no Prestressed containment tendons and anchorage components. |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Concrete elements: foundation, dome, and wall (Item Number 3.5.1-16) | Scaling, cracking, and spalling due to freeze-thaw; expansion and cracking due to reaction with aggregate | Containment ISI | Not applicable to MNGP Mark I Containment | Not applicable to MNGP Mark I Containment. There are no such concrete elements. |
| Steel elements: vent line bellows, vent headers, and downcomers (Item Number 3.5.1-17) | Cracking due to cyclic loads; crack initiation and growth due to SCC | Containment ISI and containment leak rate test | Primary Containment Inservice Inspection Program (B2.1.26); 10 CFR part 50, Appendix J program (B2.1.1) | Consistent with GALL Report with acceptable exceptions in B2.1.1. Further evaluation is recommended (See Section 3.5.2.2.1.7) |
| Steel elements: suppression chamber liner (Item Number 3.5.1-18) | Crack initiation and growth due to SCC | Containment ISI and containment leak rate test | Not applicable to MNGP Mark I Containment | Not applicable to MNGP Mark I Containment |
| Steel elements: drywell head and downcomer pipes (Item Number 3.5.1-19) | Fretting and lock up due to wear | Containment ISI | Primary Containment Inservice Inspection Program (B2.1.26) is used to manage loss of material consistent with GALL line II.B1.1.1-a. | Consistent with GALL Report. Loss of material envelops wear. (See Section 3.5.2.1.2) |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| All Groups except Group 6: accessible interior/exterior concrete steel components (Item Number 3.5.1-20) | All types of aging effects | Structures Monitoring | Structures Monitoring Program (B2.1.31) | Consistent with GALL Report, with enhancements, which recommends further evaluation (See Section 3.5.2.2.2.1) |
| Groups 1-3, 5, 7-9: inaccessible concrete components, such as exterior walls below grade and foundation (Item Number 3.5.1-21) | Aging of inaccessible concrete areas due to aggressive chemical attack, and corrosion of embedded steel | Plant-specific | None. MNGP meets the criteria. | Consistent with GALL Report, with enhancements, which recommends further evaluation (See Section 3.5.2.2.2.2) |
| Group 6: all accessible / inaccessible concrete, steel, and earthen components (Item Number 3.5.1-22) | All types of aging effects, including loss of material due to abrasion, cavitation, and corrosion | Inspection of water-control structures or FERC/US Army Corp of Engineers dam inspection and maintenance | Structures Monitoring Program (B2.1.31) | Consistent with GALL Report (See Section 3.5.2.1) |
| Group 5: liners (Item Number 3.5.1-23) | Crack initiation and growth due to SCC; loss of material due to crevice corrosion | Water chemistry and monitoring spent fuel pool water level | Plant Chemistry Program (B2.1.25) and System Condition Monitoring Program (B2.1.32) | Consistent with GALL Report with acceptable exceptions in Plant Chemistry (See Section 3.5.2.1) |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Groups 1-3, 5, 6: all masonry block walls (Item Number 3.5.1-24) | Cracking due to restraint, shrinkage, creep, and aggressive environment | Masonry Wall | Structures Monitoring Program (B2.1.31) | Consistent with GALL Report with enhancements in the Structures Monitoring Program to include Masonry Walls. |
| Groups 1-3, 5, 7-9: foundation (Item Number 3.5.1-25) | Cracks, distortion, and increases in component stress level due to settlement | Structures Monitoring | Structures Monitoring only for the Fuel Oil Transfer House | Consistent with GALL Report (See Section 3.5.2.2.1.2) |
| Groups 1-3, 5-9: foundation (Item Number 3.5.1-26) | Reduction in foundation strength due to erosion of porous concrete subfoundation | Structures Monitoring | None<br><br>GALL Report criteria satisfied | Consistent with GALL Report (See Section 3.5.2.2.1.2) |
| Groups 1-5: concrete (Item Number 3.5.1-27) | Reduction of strength and modulus due to elevated temperature | Plant-specific | None<br><br>Concrete temperatures do not exceed GALL Report limits | Consistent with GALL Report, which recommends further evaluation (See Section 3.5.2.2.1.3) |
| Groups 7, 8: liners (Item Number 3.5.1-28) | Crack initiation and growth due to SCC; loss of material due to crevice corrosion | Plant-specific | None | MNGP has no Group 7 (concrete tanks) or Group 8 (steel tanks) with liners |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| All Groups support members: anchor bolts, concrete surrounding anchor bolts, welds, grout pad, bolted connections, etc. (Item Number 3.5.1-29) | Aging of component supports | Structures Monitoring | Structures Monitoring Program (B2.1.31) | Consistent with GALL Report which recommends further evaluation (See Section 3.5.2.2.3.1) |
| Groups B1.1, B1.2, and B1.3: support members: anchor bolts and welds (Item Number 3.5.1-30) | Cumulative fatigue damage (CLB fatigue analysis exists) | TLAA evaluated in accordance with 10 CFR 54.21(c) | TLAA | This TLAA is evaluated in Section 3.5.2.2.3.2 |
| 3.5.1-31 | PWR Only | | | |
| Groups B1.1, B1.2, and B1.3: support members: anchor bolts, welds, spring hangers, guides, stops, and vibration isolators (Item Number 3.5.1-32) | Loss of material due to environmental corrosion; loss of mechanical function due to corrosion, distortion, dirt, overload, etc. | ISI | ASME Section XI, subsection IWF program (B.2.20) | Consistent with GALL Report, with an enhancement in the AMP (See Section 3.5.2.1) |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Group B1.1: high strength low-alloy bolts (Item Number 3.5.1-33) | Crack initiation and growth due to SCC | Bolting integrity | None | Not applicable to MNGP. According to Table 3.5.1, there are no high strength low-alloy bolts in use at MNGP. (for structural applications). According to MNGP Bolting Integrity Program (B2.1.4), high strength bolts are used only in one application (Reactor Head Closure Studs) |

The following sections identify those line items where the project team found a difference between the GALL Report and the MNGP LRA.

3.5.2.1.1 Loss of Material due to Corrosion in Accessible Areas

In reviewing entries in Table 3.5.2-13 for Carbon Steel, Low Alloy Steel in Treated Water and Air/Gas, the project team identified some discrepancies in Notes designation for LRA line item II.B.1.1.1-a. The discrepancies were due to the use of different AMPs than the ones chosen by the applicant and the use of exceptions where none existed. The project team requested of the applicant to resolve these discrepancies. In response, as documented in applicant's letter dated August 11, 2005 (ML052280269), the applicant states:

> LRA line II.B.1.1.1-a for the component structural steel in a treated water environment for the AMP Primary Containment Inservice Inspection program, the note should have been "C" and not "D."
>
> LRA line II.B.1.1.1-a for the component structural steel in a treated water environment for the AMP Plant Chemistry program, the note should have been "E" and not "D."

LRA line II.B.1.1.1-a for the component support members, welds, bolted connections, torus internal catwalk support columns in a treated water environment for the AMP Primary Containment Inservice Inspection program, the note should have been “C” and not “D.”

LRA line II.B.1.1.1-a for the component support members, welds, bolted connections, torus internal catwalk support columns in a treated water environment for the AMP Plant Chemistry Program, the note should have been “E” and not “D.”

LRA line II.B.1.1.1-a for the component structural steel inside torus, torus internal catwalk in an air/gas environment, for the AMP Primary Containment Inservice Inspection Program, the note should have been “C” and not “D.”

Based on the above responses and on the basis that the components, material, aging management program identified in the MNGP LRA are consistent with GALL Report, the project team concluded that the applicant has appropriately addressed the aging management for the above components.

On the basis of its review, the project team finds that the applicant appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

3.5.2.1.2 Fretting and Lock Up Due to Wear

In the discussion section of Table 3.5.1, Item Number 3.5.1-19, of the MNGP LRA, the applicant states that aging management is not required for fretting and lock up due to wear based on the following:

- The drywell head does not experience a relative motion environment that would cause wear or fretting.

- Wear of bolting components during boltup or bolt removal is prevented by proper maintenance practices, thus it is not an aging issue.

- Downcomer pipes are not subject to relative motion that would cause wear or fretting.

During the audit and review, the project team asked the applicant to justify the above assessment. The applicant states that EPRI 1002950 (Structural Tools) Section 2.3.1.7 evaluates fretting as loss of material occurring as a result of relative motion between two materials. Since there is no relative motion for the drywell head and downcomer pipes, these components do not require aging management.

The applicant also states that the Primary Containment Inservice Inspection program is not used to manage fretting or lock-up due to mechanical wear of the drywell head or downcomers, but is used to manage loss of material consistent with GALL line II.B.1.1.1-a. Additionally, the downcomers are evaluated as a TLAA for fatigue (LRA Section 4).

On the basis of its review, the project team finds that the applicant 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 the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the project team finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.5.2.2 Aging Management Review Results For Which Further Evaluation Is Recommended

For AMRs that the applicant states are consistent with the GALL Report, and for which further evaluation is recommended in the GALL Report, the project team conducted its audit to determine if the applicant's references to the GALL Report in the LRA are acceptable. When further evaluation is recommended, the project team reviewed these further evaluations provided in 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 are documented in this section. These assessments are applicable to each Table 2 line-item in section 3.5 citing the item in Table 3.5.1.

Sections 3.5.2.2.1 through 3.5.2.2.3 below document the project team's assessments of the applicant's further evaluations and the AMR line items that reference these further evaluations.

#### 3.5.2.2.1 PWR and BWR Containments

The project team reviewed MNGP LRA Section 3.5.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.1, as follows.

##### 3.5.2.2.1.1 Aging of Inaccessible Concrete

The project team reviewed the MNGP 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 PWR concrete and steel containments; BWR Mark II concrete containments; and Mark III concrete and steel containments. The GALL Report recommends further evaluation of plant-specific programs to manage the aging effects for inaccessible areas if specific criteria defined in the GALL Report cannot be satisfied.

In MNGP LRA Section 3.5.2.2.1.1, the applicant states that these aging effects/mechanisms are not applicable to the MNGP containment. The project team finds that the MNGP containment is a metal shell, Mark I design.

3.5.2.2.1.2 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

The project team reviewed the MNGP 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 PWR concrete and steel containments and BWR Mark II concrete containments and Mark III concrete and steel containments. Also, reduction of foundation strength due to erosion of porous concrete subfoundations could occur in all types of PWR and BWR containments. Some plants may rely on a de-watering system to lower the site ground-water level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's structures monitoring program.

In MNGP LRA Section 3.5.2.2.1.2, the applicant addresses aging effects due to settlement. Specifically, it addresses whether there is a need to manage the aging effects/mechanisms based on a plant-specific review of the conditional requirements outlined in GALL Report. The concern of this subsection is mainly with PWR and BWR Mark II and III concrete containments. However, the settlement criteria presented in this section are applicable to all concrete foundations. The plant initial Licensing Basis did not include a program to monitor settlement. With the exception of the Diesel Fuel Oil Transfer House, no significant settlement has been observed on any major structure and de-watering systems are not used. This satisfies the GALL Report recommendations on concrete settlement, and therefore, with the exception of the Diesel Fuel Oil Transfer House, cracks, distortion, and increase in component stress levels due to settlement do not require aging management.

The applicant states that its Diesel Fuel Oil Transfer House is a moderate weight structure exerting a mean bearing pressure of about 1,100 lb. / $ft.^2$ on the underlying foundation material. The foundation material is compacted granular backfill underlain by stiff clay lenses and sandstone bedrock, and should not be susceptible to settlement under the load imposed. However the Diesel Fuel Oil Transfer House has undergone significant differential settlement. Based on plant records and settlement data, settlement of the Diesel Fuel Oil Transfer House occurred rather rapidly following construction and was probably due to washout after a rainstorm and was long ago effectively complete. Settlement data recorded annually since 1992 continues to show no significant settlement of the structure.

The applicant also states that the Structures Monitoring Program manages the aging effects for the Diesel Fuel Oil Transfer House. As part of the Structures Monitoring Program, an annual inspection of the Diesel Fuel Oil Transfer House for settlement is performed to manage the aging effects of cracks, distortion, and increase in component stress level due to settlement. Implementation of this program to manage aging effects/mechanism provides added assurance that the aging effects are not occurring; or that the aging effects are progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

The project team review and its evaluation of the Structures Monitoring Program are documented in Section 2.31 of the audit and review report. This program was found acceptable for managing the aging effects of cracks, distortion, and increase in component stress level due to settlement since it includes inspections for settlement.

The applicant also addresses the aging effects of all types of PWR and BWR containments due to erosion of porous concrete subfoundations. Specifically, it addresses whether there is a need to manage the aging effects/mechanisms based on a plant-specific review of the conditional requirements outlined in the GALL Report. The applicant's response to erosion of cement from porous concrete subfoundations, as described in Information Notices 97-11 and 98-26, concluded that foundation materials do not contain any porous layers. The concrete base or lean concrete fill material used beneath major building foundations did not include high-alumina cement. MNGP does not rely on a de-watering system to lower site ground water.

The applicant concludes that the GALL Report recommendations are satisfied for porous concrete subfoundations, and therefore the aging effects due to erosion of porous concrete subfoundations do not necessitate aging management.

The project team finds the applicant's further evaluation of both settlement and erosion of porous concrete subfoundations to be acceptable, on the basis that (a) the effects of differential settlement of the Diesel Fuel Oil Transfer House are monitored during inspections under the structures monitoring program; (b) the applicant does not have porous concrete subfoundations; and (c) the applicant does not employ a de-watering system.

3.5.2.2.1.3 Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature

The project team reviewed the 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 and BWR Mark II concrete containments and Mark III concrete and steel containments. The GALL Report recommends further evaluation if any portion of the concrete containment components exceeds specified temperature limits (i.e., general area temperature 66/C [150/F] and local area temperature 93/C [200/F]).

In MNGP LRA Section 3.5.2.2.1.3, the applicant addresses aging effects due to elevated temperatures of concrete. Specifically, it discusses whether there is a need to manage the aging effects/ mechanisms based on a plant-specific review of the conditional requirements outlined in the GALL Report.

The applicant states that the concern is mainly with PWR and BWR Mark II and III concrete containments. However, the temperature criteria presented in this section are applicable to all concrete. Plant documents confirm that concrete elements are not subject to elevated temperatures in excess of 150/ F general area and 200/ F local area. Plant areas that bound high temperature considerations are the drywell general area and biological shield wall piping penetration local area, which experience temperatures of 135/ F and 179/ F, respectively.

The project team reviewed and determined that the applicant has evaluated the temperatures of hot piping penetrations considering the presence of insulation, which is credited with maintaining the penetration temperatures below the local limits of $200^{\circ}$ F. Insulation is included in the license renewal scope and is subject to AMR.

The project team finds that the applicant is consistent with the GALL Report and has demonstrated that the temperatures do not exceed the GALL temperatures for which evaluation is required.

3.5.2.2.1.4 Loss of Material Due to Corrosion in Inaccessible Areas of Steel Containment Shell or Liner Plate

The project team reviewed the 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 PWR and BWR containments. The GALL Report recommends further evaluation of plant-specific programs to manage this aging effect for inaccessible areas if specific criteria defined in the GALL Report cannot be satisfied.

In MNGP LRA Section 3.5.2.2.1.4, the applicant addresses loss of material due to corrosion for the drywell shell and the drywell support skirt in inaccessible areas (i.e., embedded in concrete). Specifically, it discusses whether there is a need to manage the aging effects/mechanisms based on a plant-specific review of the conditional requirements outlined in the GALL Report. The requirements specified in the GALL Report for concrete quality, inspections, and housekeeping are satisfied. Therefore, a plant-specific aging management program for loss of material due to corrosion of steel elements in inaccessible areas is not required.

The applicant also states that the Protective Coating Monitoring & Maintenance program is not credited for managing loss of material due to corrosion but is credited for preventing the degradation of coatings that could lead to the clogging of ECCS suppression pool suction strainers. Implementation of these programs to manage the aging effect/mechanism provides added assurance that the aging effect is not occurring or that the aging effect is progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

The project team reviewed Section 3.5.2.2.2.1 and determined that the applicant satisfies the specific criteria defined in the GALL Report for preventing loss of material due to corrosion for the drywell shell and the drywell support skirt in inaccessible areas (i.e., embedded in concrete). The project team reviewed the applicant documents that specified that 1) plant concrete meets ACI 318 or 349 criteria, 2) concrete around the outside of the drywell adjacent to the moisture barrier is inspected by their structures monitoring program, 3) the moisture barrier is included in the scope of their primary containment in-service inspection program, and 4) borated water leaks do not apply for BWR plants. Therefore, the project team determined that further evaluation is not necessary.

The project team finds that the applicant is consistent with the GALL Report, and a plant-specific aging management program for loss of material is not required.

3.5.2.2.1.5 Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature

In Section 3.5.2.2.1.5 of the MNGP LRA, the applicant states that this is not applicable for a Mark I Containment. The project team concurred with the applicant.

3.5.2.2.1.6 Cumulative Fatigue Damage

Cumulative fatigue is a TLAA, as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The evaluation of this TLAA is performed by NRR-DE staff and addressed in Section 4 of the SER related to the LRA.

3.5.2.2.1.7 Cracking Due to Cyclic Loading and SCC

The project team reviewed the 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.

In MNGP LRA Section 3.5.2.2.1.7, the applicant lists components associated with primary containment that require aging management for cracking due to cyclic loading given that CLB fatigue analyses were not part of their original design bases. Specifically, components requiring aging management for cracking due to cyclic loading include drywell penetrations, drywell penetration sleeves, and associated dissimilar metal welds. These components are designed to stress levels without requiring fatigue analyses and thus fine cracks are unlikely to occur. Therefore, existing requirements for leak rate testing per the 10 CFR 50, Appendix J program and surface inspections per the Primary Containment Inservice Inspection program are adequate to detect cracking due to cyclic loading.

The applicant also lists components associated with primary containment that require aging management for crack initiation and growth due to stress corrosion cracking (SCC), specifically the stainless steel vent line bellows and drywell penetration bellows. The GALL Report states that weld Exam Categories E-B (pressure retaining welds, visual VT-1 examination method) and E-F (dissimilar pressure retaining welds, surface examination method) for vent line bellows assemblies and other penetration bellows assemblies are warranted for the extended period of operations.

The applicant states that the MNGP operating history on bellows replacements is limited to bellows X-16B. Leakage was identified during LLRT testing and not a result of cracks observed during a visual examination. The leakage was identified at the outer most bellows from a small failure underneath the outer most collar of the expansion joint. No cracks in the weld metal were identified. Industry operating history has identified cracks of the bellows but none in the weld metal. Welds for bellows assemblies are in a sheltered, non-corrosive environment. Additionally, bellows assemblies are located outside primary containment in an air/gas environment where temperatures are not expected to exceed threshold limits for stress corrosion cracking. In light of the non-aggressive environmental exposures and plant-specific and industry operating histories, weld examinations utilizing optional Examination Categories E-B and E-F are not warranted. Existing requirements for visual examinations, in accordance with ASME Section XI, Subsection IWE, Examination Category E-A, and Appendix J leak rate testing, Examination Category E-P should be sufficient to detect cracking of the bellows assemblies.

The applicant concludes that implementation of these programs to manage aging effects/ mechanisms provides added assurance that the aging effects are not occurring or that the aging effects are progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

The project team review of the applicant's Primary Containment Inservice Inspection program and the 10 CFR 50, Appendix J program and its evaluation are documented in Sections 2.26 and 2.1 of the audit and review report, respectively. These programs were found acceptable for managing aging of loss of material due to corrosion in accessible areas only.

The project team reviewed MNGP-specific and industry information on cracking of containment penetrations (including penetration sleeves, penetration bellows, and dissimilar metal welds) due to cycling loading and SCC and discussed it with the applicant. The project team concluded that the applicant's further evaluation is acceptable.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.7 for further evaluation. For those line-items that apply to MNGP LRA Section 3.5.2.2.1.7, the project team finds that the applicant is consistent with the GALL Report and 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 Class 1 Structures

The project team reviewed MNGP LRA Section 3.5.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2, as follows.

3.5.2.2.2.1 Aging of Structures Not Covered by Structures Monitoring Program

The project team reviewed the 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 Subsection 3.5.2.2.1.3 for item (8).

In MNGP LRA Section 3.5.2.2.2.1, the applicant discusses various aging effects for concrete and carbon steel components. The applicant specifically discusses whether there is a need to manage the aging effects/mechanisms based on a plant-specific review of the conditional requirements outlined in the GALL Report.

The applicant states that, in accordance with the GALL Report, for carbon steel in accessible areas, loss of material due to corrosion requires aging management. Aging management of carbon steel in accessible areas is performed within the Structures Monitoring program. Through general visual inspections, the Structures Monitoring program identifies and evaluates general corrosion of carbon steel components. Protective coatings, including galvanization, are not relied upon to manage the effects of aging.

The applicant also states that the Underground Duct Bank and intake structures include below-grade steel components. Since the below-grade side of the carbon steel components are not accessible, the condition of the accessible sides of the carbon steel components, located in an atmosphere/weather, air/gas or raw water environment, will be used to evaluate the condition of the inaccessible sides of the carbon steel components.

The applicant states that, in accordance with the GALL Report and ISG-03, concrete in accessible areas requires aging management for the following aging mechanisms: freeze-thaw, leaching of calcium hydroxide, reaction with aggregates, corrosion of embedded steel and aggressive chemical attack. Aging management of concrete in accessible areas is performed through general visual inspections within the Structures Monitoring program.

The applicant states that concrete in inaccessible areas does not require aging management at MNGP. Justification is provided in the following paragraphs of the MNGP LRA.

MNGP is located in a severe weathering region according to Figure 1 of ASTM C33-90, and therefore a freeze-thaw evaluation is required. Plant documents confirm that the concrete has an air content between 3 and 6%, and subsequent inspections performed on concrete in accessible areas did not exhibit degradation related to freeze-thaw. This evaluation satisfies GALL and ISG-03 condition requirements for concrete in inaccessible areas, and therefore loss of material and cracking due to freeze-thaw do not require aging management.

Plant documents confirm that the concrete was constructed in accordance with the recommendations in ACI 201.2R-77 for durability. Additionally, there is no flowing water acting on any below-grade concrete basemat or concrete wall. Building foundations may or may not fall below the ground-water table. For those below the ground-water table, evaluation shows that ground-water flow velocity is well below the threshold at which any significant erosion or leaching of calcium hydroxide is possible. This evaluation satisfies the GALL Report and ISG-03 condition requirements for concrete in inaccessible areas, and therefore increase in porosity and permeability and loss of strength due to leaching of calcium hydroxide do not require aging management.

Tests and petrographic examinations performed according to ASTM C289-64 and ASTM C295 verified that aggregates used are not reactive. This satisfies the GALL Report and ISG-03 condition requirements for concrete in inaccessible areas, and therefore expansion and cracking due to reaction with aggregates do not require aging management.

The GALL Report and ISG-03's description of an aggressive environment is pH < 5.5, chlorides >500 ppm, or sulfates > 1500 ppm. Plant documents confirm that the below-grade environment is not aggressive (MNGP data indicates that the ph is > 7.0, the chlorides are < 100 ppm and the sulfates are < 100 ppm). The Structures Monitoring program includes examinations of below-grade concrete when excavated for any reason. To ensure the below-grade environment remains non-aggressive, ground-water chemistry is monitored periodically for the above parameters as part of the Structures Monitoring program. This satisfies the GALL Report and ISG-03 condition requirements for concrete in inaccessible areas, and therefore cracking, loss of bond, and loss of material due to corrosion of embedded steel do not require aging management. Based on the above rationale, increase in porosity and permeability, cracking, and loss of material due to aggressive chemical attack do not require aging management.

Finally, the applicant states in MNGP LRA Section 3.5.2.2.2.1 that implementation of the Structures Monitoring program to manage aging effects/mechanisms provides added assurance that the aging effects are not occurring or that the aging effects are progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

The project team evaluation of the Structures Monitoring program is documented in Section 2.31 of the audit and review report.

The project team reviewed component support/aging effect combinations and the need to manage the aging effects/mechanisms based on plant-specific review of the conditional requirements outlined in the GALL Report and discussed them with the applicant. In addition, the project team reviewed the applicant’s above evaluations and found them acceptable.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.1 for further evaluation. For those items that apply to MNGP LRA Section 3.5.2.2.2.1, the project team finds that the applicant is consistent with the GALL Report and has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.2.2 Aging Management of Inaccessible Areas

The project team reviewed the 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.

In MNGP LRA Section 3.5.2.2.2.2, the applicant states that MNGP doesn't have any group 7 or 8 structures; therefore, discussion of the aging effects for these structures is not required. The applicant specifically discusses whether there is a need to manage the aging effects/mechanisms based on a plant-specific review of the conditional requirements outlined in the GALL Report. The applicant concludes that concrete in inaccessible areas does not require aging management for corrosion of embedded steel and aggressive chemical attack at MNGP. Justification is provided in Section 3.5.2.2.2.1.

The project team reviewed Section 3.5.2.2.2.1 and finds that specific criteria defined in the GALL Report are satisfied. Therefore, further evaluation is not necessary.

3.5.2.2.3 Component Supports

The project team reviewed MNGP LRA Section 3.5.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.3.

3.5.2.2.3.1 Aging of Supports Not Covered by Structures Monitoring Program

The project team reviewed the MNGP 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 MNGP LRA Section 3.5.2.2.3.1, the applicant discusses aging of component supports. It specifically discusses whether there is a need to manage the aging effects/mechanisms based on a plant-specific review of the conditional requirements outlined in the GALL Report.

The applicant states that component supports include those structural elements that are connected to the building or its structures and which extend to a system or system component for the purpose of providing support or restraint. Component supports include support members, anchor bolts, welds, bolted connections, grout pads, and building concrete at locations of expansion and grouted anchors. Inclusive in this boundary definition are any vibration isolation elements. Spray or drip shields for equipment are included with component supports. In addition, electrical and instrumentation racks, electrical panels, cabinets and enclosures, lighting fixtures, tube track, conduit and cable trays provide support and thus are included with component supports. Miscellaneous steel structures such as platforms, stairs, whip restraints, and masonry wall supports are part of the structure in which they are located.

The applicant states in the LRA the aging effects requiring management, as follows.

The aging effect requiring management for carbon steel components is loss of material. Per EPRI 1002950 Guidelines, only general corrosion is an aging mechanism applicable to loss of material for carbon steel in air/gas or atmosphere/weather environments. The EPRI guidelines also indicate that general, crevice, MIC, and pitting corrosion are applicable aging mechanisms applicable to loss of material for carbon steel in treated water and below-grade environments. Therefore, management of this aging effect is required.

The aging effect requiring management for reinforced concrete and grout components is reduction in concrete anchor capacity due to local concrete degradation. The only mechanism applicable to this aging effect is service-induced cracking or other concrete aging mechanism. Operating experience has shown that service-induced cracking can occur in concrete and grouted foundations. Concrete expansion bolts (anchors) can lose anchor capacity due to concrete or grout degradation. Therefore, management of this aging effect is required.

The aging effect requiring management for elastomers (rubber, neoprene, silicone, etc.) is reduction or loss of isolation function. The aging mechanisms applicable to this aging effect are radiation hardening, temperature, humidity, and sustained vibratory loading. Operating experience has also shown that elastomer materials can degrade over time. Therefore, management of this aging effect is required.

The applicant also discusses in the LRA the AMPs used in addressing aging management, as follows.

The System Condition Monitoring program is used to identify and correct aging concerns for component supports in an air/gas or atmosphere/weather environment. Through general visual inspections, the System Condition Monitoring program identifies and evaluates general corrosion of carbon steel components, service-induced cracking of grout and concrete local to support anchorage as well as degradation due to radiation hardening, temperature, humidity, and sustained vibratory loading of vibration isolation elements.

The Structures Monitoring program is used to identify and correct aging concerns with miscellaneous steel components in an air/gas environment. Through general visual inspections, the Structures Monitoring program identifies and evaluates general corrosion of carbon steel components as well as service-induced cracking and degradation of grout and concrete local to the anchorage.

The Buried Piping & Tanks Inspection program is used to identify loss of material for carbon steel conduit and the Diesel Fuel Oil Storage Tank Flood Tie-Downs in a below-grade environment through internal inspections of buried tanks, system functional testing, and periodic inspections of buried pipe. A condition assessment evaluation is made of the buried conduit and the Diesel Fuel Oil Storage Tank Flood Tie-Downs such that repairs can be made, if necessary, prior to loss of intended function.

Access to the components inside the torus is limited. Since the Primary Containment Inservice Inspection program inspects components inside the torus when available, it is relied upon to manage the aging effects of the miscellaneous steel components, support members, welds, and bolted connections located inside the torus. Through general visual inspections, the Primary Containment Inservice Inspection program identifies and evaluates general (environmental), crevice, galvanic, MIC, and pitting corrosion of carbon steel components in treated water and general corrosion in air/gas.

The applicant finally stated that implementation of these programs to manage aging effects/mechanisms provides added assurance that the aging effects are not occurring or that the aging effects are progressing very slowly such that the component's intended function will be maintained during the period of extended operation.

The project team reviewed component support/aging effect combinations which are not addressed by structures monitoring program and discussed them with the applicant. The project team concluded that the appropriate Aging Management programs were used.

The project team evaluation of the Structures Monitoring program is documented in Section 2.31 of the audit and review report.

The project team evaluation of the System Condition Monitoring program is documented in Section 2.32 of the audit and review report.

The project team evaluation of the Buried Piping and Tanks program is documented in Section 2.5 of the audit and review report.

The project team evaluation of the Primary Containment Inservice Inspection program is documented in Section 2.26 of the audit and review report.

The project team finds that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.3.1 for further evaluation. For those items that apply to MNGP LRA Section 3.5.2.2.3.1, the project team finds that the applicant is consistent with the GALL Report and 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).

3.5.2.2.3.2 Cumulative Fatigue Damage Due to Cyclic Loading

Cumulative fatigue is a TLAA, as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c)(1). The evaluation of this TLAA is performed by NRR-DE staff and addressed in Section 4 of the SER related to the LRA. Therefore, the project team did not review this item.

Conclusion. On the basis of its audit for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the project team determines that (1) those attributes or features for which the applicant claimed consistency with the GALL Report were indeed consistent and (2) the applicant adequately addressed the issues that were further evaluated. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

#### 3.5.2.3 Aging Management Review Results That Are Not Consistent with the GALL Report or Not Addressed in the GALL Report

In MNGP LRA Tables 3.5.2-1 through 3.5.2-18, 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.

##### 3.5.2.3.1 AMR Results Where No Aging Effects Were Identified (MNGP LRA Tables 3.5.2-1 through 3.5.2-18)

In MNGP LRA Tables 3.5.2-1 through 3.5.2-18, the applicant identified AMR results line-items where no aging effects were identified as a result of the aging review process. Specifically, instances in which the applicant states that no aging effects were identified occurred when components fabricated from stainless steel material exposed to air/gas. No aging effects are considered to be applicable to components fabricated from stainless steel material exposed to air/gas environments.

On the basis of the project team's review of current industry research and operating experience, stainless steel in dry air or gas (such as nitrogen, carbon dioxide, freon and halon) exhibits no aging effect and 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 stainless steels are highly resistant to corrosion in dry atmospheres in the absence of corrosive species, which would be the case for the gases referenced above (Ref: Metals Handbook, Volumes 3 [p. 65] and 13 [p.555], Ninth Edition, American Society of Metals International, 1980 and 1987). Therefore, the project team finds that air/gas on stainless steel will not result in aging that will be of concern during the period of extended operation. Therefore, the project team concludes that there are no applicable aging effects requiring management for stainless steel components exposed to air, or gas environments.

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

3.5.2.3.2 Structures and Component Supports - Hangers and Supports – Summary of Aging Management Evaluation – (MNGP LRA Table 3.5.2-6)

The project team reviewed MNGP LRA Table 3.5.2-6, which summarizes the results of AMR evaluations for the Hangers and Supports group.

In MNGP LRA Table 3.5.2-6, the applicant proposes to manage loss of material/crevice, MIC, and pitting corrosion of stainless steel materials for supports for ASME Class MC components (i.e., vent header column support pins exposed to treated water environment using MNGP AMP B2.1.3, “ASME Section XI, Subsection IWF”).

The project team reviewed ASME Section XI, Subsection IWF program, and its evaluation is documented in Section 2.3 of this report.

The MNGP ASME Section XI, Subsection IWF program is part of the MNGP ASME Section XI Inservice Inspection Program. It provides for condition monitoring of Class 1, 2, 3, and MC component supports. It will be enhanced to provide inspections of class MC component supports consistent with the GALL Report, Chapter III, Section B1.3. The parameters monitored/inspected is loss of material and loss of mechanical function. The nondestructive examination technique used is the VT-3 visual examination method to detect unacceptable conditions such as loss of material and loss of mechanical function.

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/crevice, MIC, and pitting corrosion of stainless steel material exposed to treated water environment are effectively managed using ASME Section XI, Subsection IWF program. On this basis, the project team finds that management of loss of material/crevice, MIC, and pitting corrosion in Hangers and Supports is acceptable.

3.5.2.3.3 Structures and Component Supports - Primary Containment – Summary of Aging Management Evaluation – (MNGP LRA Table 3.5.2-13)

The project team reviewed MNGP LRA Table 3.5.2-13, which summarizes the results of AMR evaluations for the Primary Containment Structure.

In MNGP LRA Table 3.5.2-13, the applicant proposes to manage loss of material/crevice, MIC, and pitting corrosion of stainless steel materials for Thermowells exposed to treated water environment using the following three MNGP AMPs: B2.1.25, “Plant Chemistry Program,” B2.1.26, “Primary Containment Inservice Inspection Program, and B2.1.1, “10 CFR 50, Appendix J Program.”

The project team reviewed the Plant Chemistry program, the Primary Containment Inservice Inspection program, and the 10 CFR 50, Appendix J program, and their evaluation is documented in Sections 2.25, 2.26, and 2.1 of this audit and review report.

Pitting of stainless steel components is primarily related to the presence of detrimental ionic species such as chlorides, fluorides and sulfates. Crevice corrosion of stainless steel components is primarily related to the presence of significant levels of dissolved oxygen. The Plant Chemistry program is used to manage these aging effects by ensuring that corrosive ion concentrations do not exceed acceptance limits and that pH remains within an acceptable range. In addition, this program controls the growth of organic substances, thus eliminating MIC.

The Primary Containment Inservice Inspection program specifies visual examination of accessible surfaces on the containment pressure retaining boundary, internal vent system, and steel components within the torus to detect indications of damage or deterioration that could adversely affect the intended functions of the containment system.

The 10 CFR 50, Appendix J program specifies pneumatic pressure tests and visual examinations to verify the structural and leak integrity of the primary containment.

The project team evaluation of the Plant Chemistry program is documented in Section 2.25 of the audit and review report.

The project team evaluation of the Primary Containment Inservice Inspection program is documented in Section 2.26 of the audit and review report.

The project team evaluation of the 10 CFR 50, Appendix J program is documented in Section 2.1 of the audit and review 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 material/crevice, MIC, and pitting corrosion of stainless steel material exposed to treated water environment are effectively managed using the Plant Chemistry program, the Primary Containment Inservice Inspection program, and the 10 CFR 50, Appendix J program. On this basis, the project team finds that management of loss of material/crevice, MIC, and pitting corrosion in Primary Containment is acceptable.

Conclusion. On the basis of its audit for component groups for which the AMR results are not consistent with GALL Report or not addressed in the GALL Report, the project team determines that (1) the aging management review results documented by the applicant in the LRA are reasonable and are technically justified and (2) the applicant adequately addressed the aging management issues that were evaluated. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.5.3 Conclusion

On the basis of its review, the staff concludes that the applicant has demonstrated that the aging effects associated with containments, structures, and component supports will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The project team also reviewed the applicable USAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of containments, structures, and component supports, as required by 10 CFR 54.21(d).

## 3.6 MNGP LRA Section 3.6 - Aging Management of Electrical And Instrumentation And Controls

### 3.6.1 Summary of Technical Information in the LRA

In the MNGP LRA Tables 3.6.2-1 through 3.6.2-4 (Table 2), the applicant provided a summary of the AMRs results for component types associated with (1) electrical penetrations commodity group, (2) fuse holders commodity group, (3) non-EQ cables and connections commodity group, and (4) offsite power/SBO recovery path commodity group. The summary information for each component type included intended function, material, environment, aging effect requiring management, AMPs, the GALL Report Volume 2 item, cross reference to the LRA Table 3.6.1 (Table 1), and generic and plant-specific notes related to consistency with the GALL Report.

Also, the applicant identified for each component type in the LRA Table 3.6.1, those components that are consist with the GALL Report, those that are consistent with the GALL Report in which further evaluation is recommended, and those that are not addressed in the GALL Report together with the basis of their exclusion.

### 3.6.2 Project Team Evaluation

The project team conducted its audit in accordance with SRP-LR Section 3.6.3 and the MNGP audit plan. The project team interviewed the applicant's technical project team and reviewed, in whole or in part, the documents listed in Attachment 5 of this report.

Table 3.6-1 presents the project team evaluation for electrical and instrumentation and controls.

#### 3.6.2.1 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 LRA is acceptable.

The project team reviewed its assigned 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 components that are subject to an AMR.

**Table 3.6-1 Project Team Evaluation for Electrical and Instrumentation and Controls Components in the GALL Report**

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Electrical equipment subject to10 CFR 50.49 environmental qualification (EQ) requirements (Item Number 3.6.1-01) | Degradation due to various aging mechanisms | Environmental qualification of electric components | TLAA | This TLAA is evaluated in Section 4.7 of the SER (See Section 3.6.2.2.1) |
| Electrical cables and connections not subject to 10 CFR 50.49 EQ requirements (Item Number 3.6.1-02) | Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced insulation resistance (IR); electrical failure caused by thermal/ thermoxidative degradation of organics, radiolysis and photolysis (ultraviolet [UV] sensitive materials only) of organics; radiation-induced oxidation; moisture intrusion | Aging management program for electrical cables and connections not subject to 10 CFR 50.49 EQ requirements | Electrical cables & connectors not subject to 10 CFR 50.49 environmental qualification requirements program (B2.1.15) | Consistent with GALL (See Section 3.6.2.1) |

| Component Group | Aging Effect/ Mechanism | AMP in GALL Report | AMP in LRA | Project Team Evaluation |
|---|---|---|---|---|
| Electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance (Item Number 3.6.1-03) | Embrittlement, cracking, melting, discoloration, swelling, or loss of dielectric strength leading to reduced IR; electrical failure caused by thermal/ thermoxidative degradation of organics; radiation-induced oxidation; moisture intrusion | Aging management programs for electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements | Electrical cables not subject to 10 CFR 50.49 environmental qualification requirements used in instrumentation circuits (B2.1.16) | Consistent with GALL (See Section 3.6.2.1) |
| Inaccessible medium voltage (2 kV to 15 kV) cables not subject to 10 CFR 50.49 EQ requirements (Item Number 3.6.1-04) | Formation of water trees; localized damage leading to electrical failure (breakdown of insulation) caused by moisture intrusion and water trees | Aging management program for inaccessible medium-voltage cables not subject to 10 CFR 50.49 EQ requirements | Inaccessible medium voltage (2kV to 34.5 kV) cables not subject to 10 CFR 50.49 EQ requirements (B2.1.22) | Consistent with GALL (See Section 3.6.2.1) |
| 3.6.1-05 | PWR Only | | | |

Conclusion. The staff has evaluated the applicant's claim of consistency with the GALL Report. The staff 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, the staff finds that the AMR results, which the applicant claimed to be consistent with the GALL Report, are consistent with the AMRs in the GALL Report. Therefore, the staff finds that the applicant has demonstrated that the effects of aging for these components will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.6.2.2 Aging Management Review Results For Which Further Evaluation Is Recommended

For some line-items assigned to the project team that were consistent with the GALL Report in the LRA Tables 3.6.2-1 through 3.6.2-4, the GALL Report recommends further evaluation. When further evaluation is recommended, the project team reviewed these further evaluations provided in LRA Section 3.6.2.2 against the criteria provided in the SRP-LR Section 3.6.3.2. 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 3.6 citing the item in Table 3.6.1.

#### 3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

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 MNGP 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 determines that the applicant adequately addressed the issues that were further evaluated. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.6.2.3 Aging Management Review Results That Are Not Consistent with the GALL Report or Not Addressed in the GALL Report

In LRA Tables 3.6.2-1 through 3.6.2-4, 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.

#### 3.6.2.3.1 AMR Results Where No Aging Effects Were Identified (MNGP LRA Tables 3.6.2-1 through 3.6.2-4)

In LRA Table 3.6.2-1, the applicant identified one AMR results line item where no aging effects were identified as a result of its aging review process. Specifically, the applicant states that no aging effects occurred when components fabricated from epoxy, fiberglass, and hypalon paint material were exposed to heat, radiation, and moisture environment. The materials which are subject to aging that are installed in the penetration are epoxy, fiberglass, and hypalon paint. These materials have been evaluated in the Environmental Qualification (EQ) calculation associated with General Electric penetrations. The material fiberglass is a spun glass inert material and is not susceptible to significant thermal degradation. Epoxy is considered to be the most susceptible to radiation effects of the two organic materials, epoxy and hypalon paint. Per MNGP's EQ calculation, when exposed to radiation levels of 1.0E+08 Rads, epoxy remains unchanged. The epoxy and hypalon paint have been evaluated in an environment of 135°F. The calculated lifetime of these two materials are 146.74 years and 194.98 years, respectively. These values are far in excess of the required 60-year service life. Since the evaluated temperature and radiation levels of the organic materials are in excess of that to which the materials are exposed (service conditions at MNGP for the drywell are 135°F and 1.58E+07Rads), the materials are shown to have an expected lifetime in excess of 60 years.

The expected lifetime of a component is the amount of time to which the component could be exposed to a defined environment and still perform its intended function. When it can be shown that a component has an expected lifetime in excess of its intended service life, there are no aging effects which require management since the component is still capable of performing its intended function. No aging effects are considered to be applicable to components fabricated from epoxy, fiberglass, and hypalon paint material exposed to heat, radiation, and moisture environments.

On the basis of its review of current industry research and operating experience, the project team finds that heat, radiation, or moisture on epoxy, fiberglass, and hypalon paint will not result in aging that will be of concern during the period of extended operation. Fiberglass is a spun glass inert material and is not susceptible to significant thermal degradation. Epoxy and hypalon paint are organic materials are considered inaccessible. These materials have been environmentally qualified, like cable and connection insulation, for the expected heat, radiation, and moisture environment in excess of their intended service life. If aging effects are identified pursuant with MNGP AMP B2.1.15, “Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program,” inaccessible epoxy and hypalon paint material are required to be addressed as part of AMP B2.1.15 corrective actions. Therefore, the project team concludes that there are no applicable aging effects requiring management for epoxy, fiberglass, and hypalon paint components exposed to a heat, radiation, and moisture environments.

In LRA Table 3.6.2-2, the applicant identified AMR results line items where no aging effects were identified as a result of its aging review process. Specifically, instances in which the applicant stated that no aging effects were identified occurred (1) when components fabricated from various insulating materials (such as Phenolic or Melamine) exposed to heat and radiation environments and (2) when components fabricated from copper, brass, and steel material exposed to thermal cycling, vibration, electrical transients, mechanical stresses, corrosion, chemical contamination, and oxidation environments.

Components fabricated from various insulating materials such as Phenolic or Melamine exposed to heat or radiation

The average temperature where fuse holders are located is 85°F and the radiation exposure is 1.11E+05Rads. These temperature and radiation levels are less than the insulating material 60 year service limiting temperature of 205°F and radiation dose of 5E+07Rads. Operating experience demonstrates no aging effect when insulating materials such as Phenolic or Melamine are exposed for 60 years at a service limiting temperature of 205°F and radiation dose of 5E+07Rads. No aging effects are considered to be applicable components fabricated from various insulating materials (such as Phenolic or Melamine) exposed to heat and radiation environments.

On the basis of its review of current industry research and operating experience, the project team finds that heat and radiation on various insulating materials such as Phenolic or Melamine will not result in aging that will be of concern during the period of extended operation. Fuse holders at MNGP are not exposed to temperatures to which operating experience has shown to cause the aging effect of embrittlement, cracking, melting, or discoloration. Therefore, the project team concludes that there are no applicable aging effects requiring management for various insulating materials such as Phenolic or Melamine components exposed to heat and radiation environments.

<u>Components fabricated from copper, brass, and/or steel are exposed to thermal cycling, vibration, electrical transients, mechanical stress, or corrosion, chemical contamination, oxidation</u>

Effect of thermal cycling:

Thermal cycling is an aging effect associated with power circuit operations. Operating low-current fuse holders below the design current rating will eliminate the aging effect of thermal cycling. Typically, control fuse holders are rated far in excess of the fuse rating. The fuse will limit the current to values well below the rating of the fuse holder. The low current values experienced by control circuits typically do not create thermal cycling effects. No aging effects are considered to be applicable to components fabricated from copper, brass, and/or steel material exposed to a thermal cycling environment.

On the basis of its review of current industry research and operating experience, the project team finds that thermal cycling on copper, brass, and/or steel will not result in aging that will be of concern during the period of extended operation. Fuse holders at MNGP are low current fuse holders. Operating experience shows low currents do not create thermal cycling effects. Therefore, the project team concludes that there are no applicable aging effects requiring management for copper, brass, and/or steel components exposed to a thermal cycling environment.

Effect of vibration*:*

Vibration is a result of rapid mechanical movement about a specific point at an elevated frequency. Fuse holders at MNGP are mounted on rigid walls and are not subject to vibration. No aging effects are considered to be applicable to components fabricated from copper, brass, and/or steel material exposed to a vibration environment.

On the basis of its review of current industry research and operating experience, the project team finds that vibration on the fuse holder's metallic clamp fabricated from copper, brass, and/or steel will not result in aging that will be of concern during the period of extended operation. Fuse holders at MNGP are mounted on rigid walls and are not subject to vibration. Therefore, the project team concludes that there are no applicable aging effects requiring management for copper, brass, and/or steel components exposed to a vibration environment.

Effect of electrical transients:

Electrical transients which create aging effects are those associated with power applications (i.e., large surge current transformers and power cables). These transients affect the insulation of the device and if sufficient and frequent enough, may weaken the insulation over a period of time. Fuse holders subject to an AMR at MNGP provide electrical power to fire detection components. These components are low-voltage and low-current applications. No aging effects are considered to be applicable to components fabricated from copper, brass, and/or steel material exposed to electrical transients.

On the basis of its review of current industry research and operating experience, the project team finds that electrical transients on copper, brass, and/or steel will not result in aging that will be of concern during the period of extended operation. Electrical transients in the low current application of fuse holders at MNGP are not be of sufficient magnitude to create aging effects. Therefore, the project team concludes that there are no applicable aging effects requiring management for copper, brass, and/or steel components exposed to an electrical transient environment.

Effect of mechanical stress:

Frequent manipulation is a result of removing and reinstalling the fuse from the fuse holder on a frequent time period. Aging effects resulting from frequent manipulation have a correlation to fatigue. Fuse holders at MNGP do not have the fuses removed and reinstalled on a frequent basis. No aging effects are considered to be applicable to components fabricated from copper, brass, and/or steel material exposed to a mechanical stress environment.

On the basis of its review of current industry research and operating experience, the project team finds that mechanical stress on copper, brass, and/or steel will not result in aging that will be of concern during the period of extended operation. Fuses at MNGP are not frequently removed and installed. Therefore, the project team concludes that there are no applicable aging effects requiring management for copper, brass, and/or steel components exposed to a mechanical stress environment.

Effect of corrosion, chemical contamination, and oxidation:

The aging stressors chemical contamination, corrosion, and oxidation are related to environments in which chemical vapors and water vapor create adverse localized environments. The environment “Air - Indoor” is a controlled mild environment which does not have concentrations of chemical vapors and moisture of significant amounts to create an adverse environment. Fuse holders at MNGP are operated in an “Air - Indoor” environment. No aging effects are considered to be applicable to components fabricated from copper, brass, and/or steel material exposed to chemical contamination, corrosion, and oxidation environments.

On the basis of its review of current industry research and operating experience, the project team finds that chemical contamination, corrosion, and oxidation on copper, brass, and/or steel will not result in aging that will be of concern during the period of extended operation. Fuse holders at MNGP are protected from moisture and chemical contamination. Therefore, the project team concludes that there are no applicable aging effects requiring management for copper, brass, and/or steel components exposed to chemical contamination, corrosion, and oxidation environments.

In LRA Table 3.6.2-3, the applicant identified one AMR results line item where no aging effects were identified as a result of its aging review process. Specifically, instances in which the applicant stated that no aging effects were identified occurred when components fabricated from various metal material exposed to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation environment. As supported by the DOE Cable AMG (SAND96-0344) and MNGP operating experience, the likelihood of substantially increased effects or failure rates is considered low from thermal cycling, ohmic heating, electrical transients, mechanical stress (vibration), chemical contamination, corrosion, and oxidation. No aging effects are considered to be applicable to components fabricated from various metal material exposed to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation environments.

On the basis of its review of current industry research and operating experience, the project team finds that thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation on various metals will not result in aging that will be of concern during the period of extended operation. Industry and MNGP operating experience conveys that the likelihood of substantially increased effects or failure rates will be low. Therefore, the project team concludes that there are no applicable aging effects requiring management for various metal components exposed to thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation environments.

In LRA Table 3.6.2-4, the applicant identified AMRs results line-items where no aging effects were identified as a result of its aging review process. Specifically, instances in which the applicant stated that no aging effects were identified occurred when (1) non-segregated phase bus fabricated from various metals and organic polymers, porcelain, fiberglass, and silicon rubber material exposed to indoor/outdoor air environment; (2) when high-voltage Insulators fabricated from porcelain, cement, and metal material exposed to outdoor air environment; (3) when high-voltage switchyard bus fabricated from aluminum and steel material exposed to outdoor air environment; (4) when high-voltage transmission conductors fabricated from aluminum and steel material exposed to outdoor air environment; and (5) when electrical cables and connections not subject to 10 CFR 50.49 EQ requirements fabricated from various metal (used for electrical contact) material exposed to adverse localized environment caused by thermal cycling, ohmic heating, electrical transients, vibration, chemical contamination, corrosion, and oxidation environments.

(1) Non-Segregated Phase Bus

Effect of heat and radiation on insulation:

This item is addressed in Section 3.6.2.3.5 of this report.

Effect of heat and radiation environment on RTV Silicon Rubber:

The silicon rubber is subject to a temperature of 107°F (42°C) outdoors and normal background radiation levels, and is subject to an average temperature of 85°F (29°C) indoors and a radiation dose of $\leq$ 4.20E5. This service temperature and radiation dose is below the 60-year service-limiting temperature for silicon rubber. Additionally, the silicon seals are replaced each time the bus is inspected, which is scheduled every other refueling outage, and can be considered a consumable, not subject to aging management review. No aging effects are considered to be applicable to components fabricated from silicon rubber material exposed to heat and radiation environments.

On the basis of its review of current industry research and operating experience, the project team finds that heat and radiation on silicon rubber will not result in aging that will be of concern during the period of extended operation. The heat and radiation environment to which the silicon rubber will be exposed is within the service limiting thresholds established for silicone rubber. Also, the silicon rubber is replaced every four years and is therefore considered a consumable not subject to an AMR. Therefore, the project team concludes that there are no applicable aging effects requiring management for silicon rubber components exposed to a heat and radiation environment.

Effect of vibration on steel and aluminum:

Phase bus is typically connected to static equipment that does not normally vibrate. MNGP non-segregated phase bus is rigidly connected between the station's auxiliary transformers and the 4.16kV switchgear. The non-segregated phase bus is supported by static structural components attached to concrete footings, concrete structures, and building structural steel. Due to the mass and rigidity of the supporting structures, vibration is not considered an applicable stressor for phase bus installed at MNGP. No aging effects are considered to be applicable to components fabricated from steel and aluminum material exposed to vibration environments.

On the basis of its review of current industry research and operating experience, the project team finds that vibration on steel and aluminum will not result in aging that will be of concern during the period of extended operation. A vibration environment to which the non-segregated phase bus will be exposed is non-existent due to the mass and rigidity of the supporting structures. Therefore, the project team concludes that there are no applicable aging effects requiring management for steel and aluminum components exposed to a vibration environment.

Effect of surface oxidation:

The bus bar installed in the non-segregated phase bus at MNGP is silver plated copper. Silver plating fills in the rougher surfaces of the copper bar, creates a smoother and highly conductive surface, and when compressed (bolted) blends/bonds with the other silver plated surface to create a higher percentage area of direct metal-to-metal contact for more current flow capabilities while preventing oxides (excludes oxygen at the many points or surfaces of direct contact) from forming. Additionally, the bus bar is installed in an enclosed housing sealed from the external environment with gasket material and RTV silicon rubber sealant. In addition, to the sealed environment, there are duct heaters installed in the portion of the phase bus located external to the turbine building. The regulated temperature and protection from external contaminates assist in the prevention of surface oxidation and corrosion of the non-segregated phase bus. No aging effects are considered to be applicable to components fabricated from various metals material exposed to an air environment.

On the basis of its review of current industry research and operating experience, the project team finds that air on various metals will not result in aging that will be of concern during the period of extended operation. The silver plated copper creates a higher percentage area of direct metal-to-metal contact which prevents oxides from forming. In addition, the bus is protected from external contamination and kept at a regulated temperature to assist in the prevention of surface oxidation and corrosion. Therefore, the project team concludes that there are no applicable aging effects requiring management for various metals components exposed to an air environment.

Effect of airborne contaminates and moisture on porcelain insulators:

The insulators supporting the bus are not exposed to contaminates nor moisture. The external bus enclosure provides protection from eternal contaminates and moisture resulting from atmospheric conditions. The bus duct heaters provide an elevated temperature environment which prevents moisture condensation.  Therefore, the aging mechanisms of corrosion and surface contamination are significantly reduced or eliminated.  No aging effects are considered to be applicable to components fabricated from porcelain material exposed to an air environment.

On the basis of its review of current industry research and operating experience, the project team finds that air on porcelain will not result in aging that will be of concern during the period of extended operation.  Porcelain insulators are not exposed to contaminates nor moisture.  The bus enclosure provides protection from external moisture and contaminates.  Heaters prevents moisture condensation.  Therefore, the project team concludes that there are no applicable aging effects requiring management for porcelain components exposed to an air environment.

Effect of thermal cycling of bolted connections:

This item is addressed in Section 3.6.2.3.5 of this report.

Effect of corrosion of bolting hardware:

For MNGP bus supplied by the Calvert Company, the bolting material is stainless steel.  Visual inspection of exposed bolting material has not identified any corrosion associated with the stainless steel bolting connections.  Since stainless steel is not susceptible to corrosion resulting from moisture due to its chemical composition, corrosion due to moisture is not considered an aging effect requiring management.  For MNGP bus supplied by GE, the bus and thus the bolting material is located inside the plant and is thus not exposed to moisture.  No aging effects are considered to be applicable to components fabricated from stainless steel and other metals material exposed to an air environment.

On the basis of its review of current industry research and operating experience, the project team finds that air on stainless steel and other metals will not result in aging that will be of concern during the period of extended operation.  Stainless steel is not susceptible to corrosion resulting from moisture due to its chemical composition.  Other metals are located inside of a building and are not exposed to moisture.  Therefore, the project team concludes that there are no applicable aging effects requiring management for stainless steel and other metals components exposed to an air environment.

(2) High-Voltage Insulators

Effect of surface contamination on porcelain:

MNGP is located in a rural area and is not in proximity to saltwater environments. The nearest industrial facility, which discharges any significant amount of airborne particulates, is located about 5 miles northwest of the plant.  Since the plant began operation in 1971, there has not been any regularly scheduled maintenance to remove surface contamination from the switchyard or transmission line insulators.  Additionally, from a review of operating experience, there is no indication that surface contamination has caused any age related degradation of the high voltage insulators.  No aging effects are considered to be applicable to components fabricated from porcelain material exposed to an outdoor air environment.

On the basis of its review of current industry research and operating experience, the project team finds that outdoor air on porcelain will not result in aging that will be of concern during the period of extended operation. The MNGP high voltage insulators are not located in an area subject to air borne contaminates. Therefore, the project team concludes that there are no applicable aging effects requiring management for porcelain components exposed to an outdoor air environment.

Effect of cracking on porcelain:

Cracks have also been known to occur in insulators used in strain applications when the cement that binds the parts together expands enough to crack the porcelain. This phenomenon, known as cement growth, is caused by improper manufacturing process or materials which make the cement more susceptible to moisture penetration. Porcelain cracking caused by cement growth has occurred only in isolated bad batches of insulators used in strain applications. The dates of manufacture and brands of these problem insulators are known and have been removed from service. No aging effects are considered to be applicable to components fabricated from porcelain and cement material exposed to an outdoor air environment.

On the basis of its review of current industry research and operating experience, the project team finds that outdoor air on porcelain and cement will not result in aging that will be of concern during the period of extended operation. Operating experience using the proper manufacturing processes show no aging effects. Therefore, the project team concludes that there are no applicable aging effects requiring management for porcelain and cement components exposed to an outdoor air environment.

Effect of loss of material due to wear:

Loss of material due to mechanical wear is an aging effect for strain and suspension insulators if they are subject to significant movement. Although this mechanism is possible, experience has shown that the transmission conductors do not normally swing and when they do, because of strong winds, they dampen quickly once the wind has subsided. Wear has not been identified during routine inspections of MNGP high-voltage insulators. No aging effects are considered to be applicable to components fabricated from metal material exposed to an outdoor air environment.

On the basis of its review of current industry research and operating experience, the project team finds that outdoor air on metal will not result in aging that will be of concern during the period of extended operation. Transmission conductor and thus the high voltage insulators are not subject to significant movement. Therefore, the project team concludes that there are no applicable aging effects requiring management for metal exposed components exposed to an outdoor air environment.

(3) High Voltage Switchyard Bus

Effect of vibration on switchyard bus:

Switchyard buses are connected to flexible conductors that do not normally vibrate and are supported by insulators and ultimately by static, structural components such as concrete footings and structural steel. With no connections to moving or vibrating equipment, vibration is not an applicable stressor. No aging effects are considered to be applicable to components fabricated from aluminum and steel exposed to outdoor air and vibration environments.

On the basis of its review of current industry research and operating experience, the project team finds that outdoor air and vibration aluminum and steel will not result in aging that will be of concern during the period of extended operation. Switchyard bus is not subject to vibration. Therefore, the project team concludes that there are no applicable aging effects requiring management for aluminum and steel components exposed to outdoor air and vibration environments.

Effect of oxidation on switchyard bus and connections:

All switchyard bus connections within the Offsite Power/SBO Recovery Path boundaries are bolted, welded or for jumper cables, crimped aluminum connections. Aluminum bus, solid and flexible connectors and ground straps are highly conductive but do not make good contact surface since aluminum exposed to air forms aluminum oxide on the surface, which is non-conductive. To prevent formation of aluminum oxide on the connection surfaces, the connections are cleaned with a wire brush (to remove existing aluminum oxide) and covered with a No-Ox grease to prevent air from contacting the aluminum surface. After the connection is completed, additional compound is applied and forced into every irregularity and opening in order to completely seal the joint against moisture and corrosion. The grease precludes oxidation of the aluminum surface thereby maintaining good conductivity at the bus connections. The grease is a consumable that is replaced, during bus routine maintenance. Substation connections, which include the SBO recovery path equipment connections, are monitored by routine maintenance thermography inspections on a semi annual basis. These inspections identify connections where conditions exist which have resulted in increased resistance and a subsequent rise in temperature. The inspections are scheduled in the work control process and are performed on a repetitive basis as part of routine maintenance. These routine maintenance inspections have proven to be effective in identifying conditions prior to any loss of intended function of the component. No aging effects are considered to be applicable to components fabricated from aluminum and steel exposed to outdoor air.

On the basis of its review of current industry research and operating experience, the project team finds that outdoor air on aluminum and steel will not result in aging that will be of concern during the period of extended operation. The effects from air on switchyard bus connection has been eliminated by the application of grease and its periodic replacement. In addition, connections are periodically inspected by thermography. Therefore, the project team concludes that there are no applicable aging effects requiring management for aluminum and steel components exposed to an outside air environment.

(4) High-Voltage Transmission Conductors fabricated from aluminum and steel

Effect of loss of conductor strength due to corrosion:

For transmission conductors, degradation begins as a loss of zinc from the galvanized steel core wires. Corrosion rates depend largely on air quality, which includes suspended particles chemistry, $SO_2$ concentration in air, precipitation, fog chemistry and meteorological conditions. Corrosion of transmission conductors is a very slow process that is even slower for rural areas with generally less suspended particles and $SO_2$ concentrations in the air than urban areas. MNGP is located in a rural area where airborne particle concentrations and $SO_2$ concentrations are low. No aging effects are considered to be applicable to components fabricated from aluminum and steel exposed to outdoor air.

On the basis of its review of current industry research and operating experience, the project team finds that outdoor air on aluminum and steel will not result in aging that will be of concern during the period of extended operation. Corrosion is a slow process which is slower in rural area where MNGP is located. Therefore, the project team concludes that there are no applicable aging effects requiring management for aluminum and steel components exposed to an outside air environment.

Effect of vibration:

Wind loading can cause transmission conductor vibration. Wind loading is considered in the initial design and field installation of transmission conductors and high-voltage insulators throughout the transmission and distribution network. Loss of material (wear) and fatigue that could be caused by transmission conductor vibration or sway are not considered applicable aging effects due to the lack of significant failures of this type experienced throughout the industry. No aging effects are considered to be applicable to components fabricated from aluminum and steel material exposed to an outdoor air environment.

On the basis of its review of current industry research and operating experience, the project team finds that outdoor air on aluminum and steel will not result in aging that will be of concern during the period of extended operation. Operating experience has not found failure of transmission conductors due to vibration. Therefore, the project team concludes that there are no applicable aging effects requiring management for aluminum and steel components exposed to an outside air environment.

(5) Cables and Connections

This line item is the same as a line item identified in Table 3.6.2-3 of the LRA and is addressed in Section 3.6.2.3.3 of this report.

On the basis of the project team audit and review of the MNGP LRA, the GALL Report and technical references for these materials and environments, the project team finds that the applicant has demonstrated that no aging effects are predicted for the material and environmental combinations reported and that the electrical and instrumentation and controls system components fabricated from these materials in the environments listed above so that their intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

#### 3.6.2.3.2 Electrical Components - Off Site Power/SBO Recovery Path Commodity Group - Summary of Aging Management Evaluation - MNGP LRA Table 3.6.2-4

The project team reviewed the MNGP LRA Table 3.6.2-4, which summarizes the results of AMR evaluations for the Electrical Components - Off Site Power/SBO Recovery Path Commodity Group - Summary of Aging Management Evaluation component groups.

In LRA Table 3.6.2-4, the applicant proposes to manage embrittlement, cracking, discoloration, oxidation, and loosening of bolted connections of various metals and organic polymers, porcelain, fiberglass, and silicon rubber materials for components types of non-segregated phase bus exposed to indoor and outdoor air environment using MNGP AMP B2.1.6, “Bus Duct Inspection Program.”

The project team reviewed Bus Duct Inspection program and its evaluation is documented in Section 2.6 of this report. The Bus Duct Inspection program demonstrates that the aging effects caused by ingress of moisture or contaminants (dust and debris), insulation degradation caused by heat or radiation in the presence of oxygen, and bolt relaxation caused by thermal cycling will be adequately managed. 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, discoloration, oxidation, and loosening of bolted connections of various metals and organic polymers, porcelain, fiberglass, and silicon rubber material exposed to indoor and outdoor air environment are effectively managed using Bus Duct Inspection program. On this basis, the project team finds that management of embrittlement, cracking, discoloration, oxidation, loosening of bolted connections in Electrical Components - Off Site Power/SBO Recovery Path Commodity Group - Summary of Aging Management Evaluation is acceptable.

Conclusion. On the basis of its audit for component groups for which the AMR results are not consistent with the GALL Report or not addressed in the GALL Report, the project team determines that (1) the aging management review results documented by the applicant in the LRA are reasonable and are technically justified and (2) the applicant adequately addressed the aging management issues that were evaluated. The project team finds that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

### 3.6.3 Conclusion

On the basis of its review, the project team concludes that the applicant has demonstrated that the aging effects associated with the electrical and instrumentation and controls system components will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation as required by 10 CFR 54.21(a)(3).

The project team also reviewed the applicable USAR Supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the electrical and instrumentation and controls systems, as required by 10 CFR 54.21(d).

## 4.0 Time-Limited Aging Analyses (TLAA) Audit Results

### 4.1 IRRADIATION-ASSISTED STRESS CORROSION CRACKING OF REACTOR PRESSURE VESSEL INTERNALS

Two areas of technical review are required to support an application for a renewed operating license. The first area is the Integrated Plant Assessment, described in Chapters 2 and 3 of the MNGP LRA. The second area is the identification and evaluation of plant-specific time-limited aging analyses (TLAAs). The TLAA evaluation included in this section of the audit report meets the requirements contained in 10 CFR 54.21(c) and allows the staff to make the finding contained in 10 CFR 54.29(a)(2).

#### 4.1.1 Summary of Technical Information in the Application

In MNGP LRA Section 4.4, the applicant describes the analysis of irradiation-assisted stress corrosion cracking (IASCC) of reactor pressure vessel (RPV) internals:

Austenitic stainless steel RPV internal components exposed to a neutron fluence greater than 5 x $10^{20}$ n/cm$^2$ (E > 1 MeV) are susceptible to IASCC in the BWR environment. As described in the SER to BWRVIP-26, IASCC of RPV internals is a TLAA.

Fluence calculations have been performed for the RPV and internals, including the effects of power rerate. Three components have been identified as being susceptible to IASCC for the period of extended operation: (1) top guide, (2) shroud, and (3) incore instrumentation dry tubes and guide tubes.

The top guide, shroud, and incore instrumentation dry tubes and guide tubes are susceptible to IASCC. The aging effect associated with IASCC (crack initiation and growth) will require aging management. All three components (top guide, shroud, and incore instrumentation dry tubes and guide tubes) have been evaluated by the BWRVIP, as described in the respective Inspection and Evaluation Guidelines: BWRVIP-26 (top guide), BWRVIP-76 (shroud), and BWRVIP-47 (incore instrumentation dry tubes and guide tubes). BWRVIP recommendations are implemented at MNGP by the Plant Chemistry and the Inservice Inspection programs.

### 4.1.2 Staff Evaluation

The project team reviewed the information in the MNGP LRA and observed that the austenitic stainless steel components that are exposed to a neutron fluence greater than 5 x $10^{20}$ n/cm$^2$ (E >1 MeV) and that are considered susceptible to IASCC are located in the following RPV internal components: the top guide, the shroud, and the incore instrumentation dry tubes and guide tubes. The project team reviewed the fluence calculations for the MNGP RPV and verified that other RPV internal components (e.g., the core plate) are not expected to exceed a neutron fluence greater than 5 x $10^{20}$ n/cm$^2$, and thus are not considered susceptible to IASCC. The applicant stated, in the MNGP LRA, that the aging effects due to IASCC of these RPV components are managed by three aging management programs: B2.1.2, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” B2.1.12, “BWR Vessel Internals,” and B2.1.25, “Plant Chemistry.” The applicant stated that implementation of these three AMP’s provides reasonable assurance that the aging effects due to IASCC will be managed such that the RPV internal components will continue to perform their intended functions, consistent with the licensing basis, for the period of extended operation.

The project team reviewed other applicant documents that pertain to the RPV and BWR vessel internals project (BWRVIP) documents and EPRI topical reports that apply to generic RPVs. The project team observed that, while fluence level was the primary contributor to IASCC, additional factors also contributed, or increased the susceptibility of a component, to IASCC. The project team observed that BWRVIP-41, BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines, states that such materials as austenitic stainless steel are not greatly susceptible to IASCC. The project team also observed that the SER (ML011570460) that accepted BWRVIP-41 stated that materials in an non-oxygenated environment are also not greatly susceptible to IASCC and that IASCC becomes a concern only when cracks are already present in a component. Thus, the SER stated, when an applicant can show that cracks have not occurred in components, the loss of fracture toughness resulting from IASCC will not be a significant aging effect.

The project team asked the applicant to clarify its actions regarding the above additional factors. Regarding the aggressive oxygenated environment, the applicant responded that it had implemented hydrogen water chemistry in 1989. This hydrogen water chemistry system reduces the oxidizing environment of the reactor coolant system by injecting excess hydrogen, which combines with the free oxygen that is produced by radiolysis. The dissolved oxygen content of feedwater is regulated to 20-50 ppb during power operation, which minimizes the potential for corrosion. The project team reviewed historical data from the water chemistry program and verified the low dissolved oxygen content.

In addition to those examinations that are required by the MNGP ISI program, which includes all pertinent examinations required by the BWRVIP program, MNGP performs additional examinations of the top guide grid high fluence locations using the EVT-1 visual examination method (letter from T. Palmisano, MNGP, to NRC, “Response to Request for Additional Information and Submittal of Additional Information in Support of the Monticello License Renewal Application [TAC No. MC6440],” dated June 10, 2005). In the same letter, MNGP commits to inspections of 10 percent of these locations within 12 years. The project team reviewed the applicant’s operational experience and observed that, to date, MNGP has inspected 25 percent of the high fluence locations of the top guide grid and has detected no evidence of cracking.

Lastly, the project team reviewed the fluence calculations for the RPV internals and observed that there was a factor of 30 percent that was added to the calculated fluence level results. The project team asked the applicant to clarify the purpose of this added factor. The applicant stated that this factor was added for conservatism.

The project team evaluated the RPC components for IASCC, considering that (1) these components were composed of a material that was identified in BWRVIP-41 as one that was not very susceptible to IASCC; (2) these components were in a non-aggressive, low dissolved-oxygen, environment, so, as stated in the above-referenced SER, the susceptibility of these components to IASCC is lessened; (3) no evidence of cracks have been detected in the RPV inspections that have been performed to date, so, as stated in the above-referenced SER, significant loss of fracture toughness will not result; and (4) the fluence calculations that determined the three RPV components susceptible to IASCC include an added factor of 30 percent, for conservatism. The project team concluded that the applicant appropriately described that, by implementing AMP’s B2.1.2, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” B2.1.12, “BWR Vessel Internals,” and B2.1.25, “Plant Chemistry,” the aging effects due to IASCC will be adequately managed for the period of extended operation.

During the audit and review, the project team identified an additional issue that required further clarification by the applicant. The applicant has committed to perform RPV examinations for 12 years of the period of extended operation. However, there is no commitment to perform examinations during the rest of the period of extended operation, nor is there a commitment as to what the applicant will do in the event that any RPV examination detects an indication. A Request for Additional Information (RAI 4.1-1) was issued to obtain further information to resolve this issue.

4.1.3 <u>Conclusion</u>

On the basis of its review, the project team concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended functions will be adequately managed for the period of extended operation. The project team also concluded that the USAR Supplement contains an appropriate summary description of the TLAA evaluation of IASCC for the period of extended operation, as required by 10 CFR 54.21(d). Therefore, pending successful resolution of the Open Item, the project team has reasonable assurance that the safety margins established and maintained during the current operating term will be maintained during the period of extended operation, as required by 10 CFR 54.21(c)(1).

**Attachment 1**
**Acronyms and Abbreviations**

| | |
|---|---|
| AC | Alternating Current |
| ACI | American Concrete Institute |
| ADAMS | Agency wide documents access and management system |
| ADS | Automatic Depressurization System |
| AERM | Aging Effects Requiring Management |
| AISC | American Institute of Steel Construction |
| AMP | Aging Management Program |
| AMR | Aging Management Review |
| ANSI | American National Standards Institute |
| API | American Petroleum Institute |
| APRM | Average Power Range Monitor |
| ARM | Area Radiation Monitor |
| ASCE | American Society of Civil Engineers |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society for Testing and Materials |
| ATL | Advanced Technologies and Laboratories International, Inc. |
| ATWS | Anticipated Transient Without Scram |
| ATWS-RPT | Anticipated Transient Without Scram-Recirculation Pump Trip |
| BTP | Branch Technical Position |
| BWR | Boiling Water Reactor |
| BWROG | Boiling Water Reactor Owners Group |
| BWRVIP | Boiling Water Reactor Vessel and Internals Program |
| C | Celsius |
| CASS | Cast Austenitic Stainless Steel |
| CAP | Corrective Action Program |
| CCW | Component Cooling Water/Closed Cooling Water |
| CDD | Condensate Deep Bed Demineralizer |
| CFR | Code of Federal Regulations |
| CFD | Condensate Filter Demineralizer |
| CHRS | Containment Heat Removal System |
| CLB | Current Licensing Basis |
| CRD | Control Rod Drive |
| CRDH | Control Rod Drive Housing |
| CRDM | Control Rod Drive Mechanism |
| CS | Core Spray/Carbon Steel |
| CSCS | Core Standby Cooling System |
| CST | Condensate Storage Tank |
| CW | Circulating Water |
| CUF | Cumulative Usage Factor |
| DBA | Design Basis Accident |
| DBE | Design Basis Earthquake |
| DC | Direct Current |
| DE | NRC/NRR/Division of Engineering |

| | |
|---|---|
| DG | Diesel Generator |
| DGB | Diesel Generator Building |
| DIPM | NRC/NRR/Division of Inspection Program Management |
| D/P | Differential Pressure |
| DSCSS | Drywell and Suppression Chamber Spray System |
| DWT | Demineralized Water Tank |
| | |
| EAF | Environmentally Assisted Fatigue |
| E&RC | Environmental and Radiation Control |
| ECC | Emergency Core Cooling |
| ECCS | Emergency Core Cooling System |
| EFPY | Effective Full Power Years |
| EHC | Electro-Hydraulic Control |
| EPRI | Electric Power Research Institute |
| EPU | Extended Power Uprate |
| EQ | Environmental Qualification |
| ESF | Engineered Safety Features |
| | |
| F | Fahrenheit |
| FAC | Flow Accelerated Corrosion |
| FHA | Fire Hazards Analysis |
| FO | Fuel Oil |
| FOST | Fuel Oil Storage Tank |
| FP | Fire Protection |
| FPP | Fire Protection Program |
| FSAR | Final Safety Analysis Report |
| FW | Feedwater |
| | |
| GALL | Generic Aging Lessons Learned (the GALL Report is NUREG-1801) |
| GDC | General Design Criteria |
| GE | General Electric |
| GL | Generic Letter |
| GSI | Generic Safety Issue |
| | |
| HELB | High Energy Line Break |
| HEPA | High Efficiency Particulate Air |
| HPCI | High Pressure Coolant Injection |
| HPCS | High Pressure Core Spray (not an applicable system for MGNP) |
| HVAC | Heating, Ventilating, and Air Conditioning |
| | |
| IA | Instrument Air |
| IASCC | Irradiation Assisted Stress Corrosion Cracking |
| I&C | Instrumentation and Control |
| ID | Inside Diameter |
| IE | Inspection and Enforcement (former NRC Office of Inspection and Enforcement) |
| IEEE | Institute Of Electrical And Electronic Engineers |
| IGSCC | Intergranular Stress Corrosion Cracking |
| ILRT | Integrated Leak Rate Test (Containment Type A Test) |
| IN | Information Notice |
| INPO | Institute Of Nuclear Power Operations |

| | |
|---|---|
| IPA | Integrated Plant Assessment (10 CFR 54.21(a)) |
| ISG | Interim (NRC) Staff Guidance |
| ISI | In-Service Inspection |
| | |
| KV | Kilovolt |
| | |
| LBB | Leak-Before-Break |
| LER | Licensee Event Report |
| LOCA | Loss of Coolant Accident |
| LPCI | Low Pressure Coolant Injection |
| LPCS | Low Pressure Core Spray |
| LR | License Renewal |
| LRA | License Renewal Application |
| | |
| MIC | Microbiologically Induced Corrosion |
| MNGP | Monticello Nuclear Generating Plant |
| MS | Main Steam |
| MSLB | Main Steam Line Break |
| MSR | Moisture Separator Reheater |
| MWTS | Makeup Water Treatment System |
| | |
| $n/cm^2$ | Neutrons per Square Centimeter |
| NDE | Nondestructive Examination |
| NDTT | Nil-Ductility Transition Temperature |
| NEI | Nuclear Energy Institute |
| NFPA | National Fire Protection Association |
| NMC | Nuclear Management Company |
| NPS | Nominal Pipe Size |
| NRC | Nuclear Regulatory Commission |
| NRR | NRC/Office of Nuclear Reactor Regulation |
| NSSS | Nuclear Steam Supply System |
| NUREG | Designation of publications prepared by the NRC staff |
| | |
| PASS | Post-Accident Sampling System |
| PCS | Primary Containment Structure |
| PFM | Probabilistic Fracture Mechanics |
| pH | Concentration of Hydrogen Ions |
| PM | Preventive Maintenance |
| PNS | Pneumatic Nitrogen System |
| PORV | Power-Operated Relief Valve |
| ppb | Parts per Billion |
| ppm | Parts per Million |
| P-T | Pressure-Temperature |
| PTS | Pressurized Thermal Shock |
| PVC | Polyvinyl Chloride |
| PWS | Potable Water System |
| | |
| QA | Quality Assurance |
| | |
| RAI | Request for Additional Information |

| | |
|---|---|
| RBCCW | Reactor Building Closed Cooling Water |
| RCIC | Reactor Core Isolation Cooling |
| RCPB | Reactor Coolant Pressure Boundary |
| RFP | Reactor Feedwater Pump |
| RG | Regulatory Guide |
| RHR | Residual Heat Removal |
| RLEP-B | NRC/NRR/License Renewal and Environmental Impacts Program/Section B |
| RMS | Radiation Monitoring System |
| RPV | Reactor Pressure Vessel |
| RTNDT | Reference Temperature, Nil-Ductility Transition |
| RTNDT(U) | Reference Temperature, Nil-Ductility Transition (Unirradiated) |
| RVI | Reactor Vessel Internals |
| RWCU | Reactor Water Cleanup System |
| RXS | Reactor Building Sampling System |
| | |
| SA | Service Air |
| SAT | Startup Auxiliary Transformer |
| SBO | Station Blackout |
| SC | Structure/Component (10 CFR 54.21(a)(1)), also Suppression Chamber |
| SCC | Stress Corrosion Cracking |
| SCW | Screen Wash Water |
| SDV | Scram Discharge Volume |
| SER | Safety Evaluation Report |
| SFP | Spent Fuel Pool |
| SGTS | Standby Gas Treatment System |
| SI | Safety Injection |
| SLC | Standby Liquid Control |
| SR | Safety Related |
| SRP | Standard Review Plan |
| SRP-LR | Standard Review Plan for License Renewal |
| SRV | Safety Relief Valve |
| SS | Stainless Steel |
| SSC | Systems, Structures, and Components (10CFR 54.4(a)) |
| SW | Service Water |
| | |
| TAC | Technical Assignment Control (internal NRC work management tool) |
| TB | Turbine Building |
| TBCCW | Turbine Building Closed Cooling Water |
| TGSCC | Trans-Granular Stress Corrosion Cracking |
| TLAA | Time-Limited Aging Analysis |
| | |
| UAT | Unit Auxiliary Transformer |
| USAR | Updated Final Safety Analysis Report |
| USE | Upper Shelf Energy |
| UUSE | Unirradiated Upper Shelf Energy |
| UT | Ultrasonic Test |
| | |
| VAC | Volts alternating current |
| VDC | Volts direct current |

# Attachment 2
# Project Team and Applicant Personnel

## MNGP LRA Audit and Review Project Team

Peter Wen, NRC, Team Leader
Mark Lintz, NRC, Backup Team Leader
John Knox, NRC
Brian Messitt, ATL, Lead
Robert Jackson, ATL
Chris Lapp, ATL
Spyros Traiforos, ATL

## Project Team Support

Jacob Zimmerman, Chief, NRC RLEP Section B
Daniel Merzke, NRC RLEP Project Manager
Noel Dudley, NRC RLEP Section B
Kurt Cozens, NRC RLEP Section B
Kenneth Chang, NRC RLEP Section B
Greg Cranston, NRC RLEP Section B
Linh Tran, NRC RLEP Section B

## Applicant Personnel Contacted

P. Burke
R. Dennis
R. Siepel
J. Holthaus
D. Musolf
J. Pairitz
J. Rootes
M. Aleksey
M. O'Brien
B. Johnson
W. O'Brien
W. Roman
M. Engen
D. Sexton
M. Middendorf

## Personnel Who Attended the Public Exit Meeting on August 18, 2005

S. Rakow, Minn. Department of Commerce
R. Jacobs, NMC
J. Pairitz, NMC
P. Burke, NMC
L. Ray
G. Crocker, NAWO
D. Merzke, NRC
J. Zimmerman, NRC
P. Wen, NRC
R. Oslikowski, NRC
S. Ray, NRC

**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 (Audited by DIPM)* | Corrective actions, including root cause determination and prevention of recurrence, should be timely. |
| 8 | Confirmation process (Audited by DIPM) | Confirmation process should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective. |
| 9 | Administrative controls (Audited by DIPM) | Administrative controls should provide a formal review and approval process. |
| 10 | Operating experience | Operating experience 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. |

*DIPM = Division of Inspection Program Management

## Attachment 4
## Disposition of Requests for Additional Information, LRA Supplements, and Followup Items

Items that could not be closed out at the time this audit and review report was issued are documented in the following table.

| Followup Item No. | Description | Closed to RAI (RAI Issue) |
|---|---|---|
| 1 | In lieu of crediting the MNGP AMP for selective leaching of materials, MNGP has credited the Fire Protection program (MNGP AMP B2.1.17/GALL AMP XI.M26), or the Fire Water System program (MNGP AMP B2.1.18/GALL AMP XI.27), or the Buried Piping and Tanks Inspection program (MNGP AMP B2.1.5/GALL AMP XI.M34) to manage the effects of loss of material due to selective leaching for certain Fire System components (copper alloy and gray cast iron materials in raw water environment or buried in ground environment) in Table 3.3.2-9. For other systems in raw water environment in section 3.3, MNGP has credited its selective leaching of materials program to manage the aging effects of loss of material due to selective leaching. An RAI was issued to obtain information how Fire Protection Program, Fire Water System Program and Buried Piping and Tanks Inspection Program are able to detect selective leaching. | RAI 3.3.2.3.5-1 |
| 2 | The applicant has committed to perform the examination of 10 percent of the high-fluence locations of the top guide grids within 12 years during the period of extended operation. However, there is no commitment to perform examinations during the rest of the period of extended operation, nor is there a commitment as to what the applicant will do in the event that any examination detects an indication. An RAI was issued to obtain information to clarify the applicant's commitments. | RAI 4.1-1 |
| 3 | In the Enhancement Section of B2.1.5, MNGP states that the Buried Piping and Tanks Inspection program will be revised to specify a 10-year internal inspection frequency for Diesel Fuel Oil Storage Tank, T-44. An RAI was issued to obtain information concerning whether MNGP plans to utilize this enhancement, internal inspection of the Diesel Fuel Oil Storage Tank, in lieu of the external inspection, as recommended by GALL AMP XI, M34. | RAI 2.1.5-1 |

## 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 report. In addition, inclusion of a document in this list does not imply NRC acceptance of the document.

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| 10 CFR Part 50, Appendix J Program (MNGP AMP B2.1.1) | 10 CFR Part 50, Appendix J (GALL AMP XI.S4) | MNGP:<br><br>EWI-08.06.01, "Primary Containment Leakage Rate Testing Program," Rev. 2<br><br>Procedure 0136, "Integrated Primary Containment Leak Rate Test," Rev. 13<br><br>Procedure 0137, "Master Local Leak Rate Test," Rev. 25<br><br>Procedure 0138, "Drywell Personnel Airlock Pressure and Leak Test," Rev. 16<br><br>Procedure 0135, "Pressure-Suppression Chamber Painted Surface Internal Inspection," Rev. 8<br><br>Procedure0140, "Drywell Interior Surface Inspection," Rev. 5<br><br>Procedure 0446-B, "Type B and C Combined Leakage Check," Rev. 2<br><br>Procedure 0515, "Primary Containment Visual Examination for Structural Problems," Rev. 2<br><br>Procedure 4320-PM, "Drywell Penetration Airlock," Rev. 6<br><br>Procedure 8080, "Primary Containment Hatch Closure," Rev. 8 |
| ASME Section XI, Inservice Inspection, Subsections IWB, | ASME Section XI Inservice Inspection, | 4 AWI-09.04.00," Inservice Inspection Licensee Control Program," Rev. 3 |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| IWC, and IWD Program, (MNGP AMP B2.1.2) | Subsection IWB, IWC, and IWD (GALL AMP XI.M1) | 4 AWI-07.03.01, “Nondestructive Examination, “ Rev. 5<br><br>4 AWI-09.04.02, “System and Component Pressure Testing Plan,” Rev. 11<br><br>4 AWI-09.04.03, “ ASME Section XI Repair/Replacement Program,” Rev. 8<br><br>“Inservice Inspection Examination Plan, Fourth Interval May 1, 2003 through May 31, 2012,” Rev. 2<br><br>EWI-08.01.01, “Boiling Water Reactor Vessel Internals Project (BWRVIP) Administrative Manuel,” Rev. 4<br><br>EWI-08.01.02, “BWRVIP Implementation Guidelines,” Rev. 1<br><br>EWI-08.01.03, “Augmented Reactor Vessel Inspections,” Rev. 1<br><br>EWI-09.04.00, “ASME Section XI Inservice Inspection Program,” Rev. 0<br><br>PEI-02.03.01, “Ultrasonic Examination of Ferritic Piping Welds to Appendix VIII,” Rev. 0<br><br>PEI-02.05.01, “Visual Examination,” Rev. 0<br><br>PEI-02.05.05, “Visual Examination of Monticello Reactor Vessel Inspection,” Rev. 0<br><br>PEI-02.08.03, “Inservice Inspection Flaw Evaluation, “ Rev. 0 |
| ASME Section XI, Subsection IWF Program (MNGP AMP B2.1.3) | ASME Section XI, Subsection IWF (GALL AMP XI.S3) | <u>MNGP</u>:<br><br>4 AWI-09.04.00, “Inservice Inspection Licensee Control Program,” Rev. 2<br><br>4 AWI-07.03.01, “Nondestructive Examination,” Rev. 4 |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| | | "Inservice Inspection Examination Plan Fourth Interval May 1, 2003 Through May 31, 2012," Rev. 2<br><br>EWI-09.04.00, "ASME Section XI Inservice Inspection Program," Rev. 0<br><br>*Unnumbered Document*, "Containment Inspection-Examination Plan (IWE)," Rev. 1 |
| Bolting Integrity Program (MNGP AMP B2.1.4) | Bolting Integrity (GALL AMP XI.M18) | <u>MNGP</u>:<br><br>MMP-008, "Bolting Practices," Rev. 4<br><br>Form 3632, "Pocket Torquing Guide," Rev. 3<br><br>MDI-09.01, "Torque Determination Guide," Rev. 2<br><br>ESM-02.03, "Standard Construction Practices (Mechanical)," Rev. 5<br><br>MWI-8-M-4.10, "Concrete Expansion Bolt Installation," Rev. 8<br><br>ESM-04.02, "Design Requirements, Practices and Topics (Civil and Structural)," Rev. 2<br><br>ESM-02.02, "Design Requirements, Practices and Tools (Mechanical)," Rev. 13<br><br>MWI-8-M-4.06, "Conductor Termination," Rev. 5<br><br>MWI-8-M-4.11, "Electrical Equipment Installation," Rev. 5<br><br>MWI-8-M-4.05, "Raceway Installation," Rev. 4 |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| Buried Piping and Tanks Inspection Program (MNGP AMP B2.1.5) | Buried Piping and Tank Inspection (GALL AMP XI.M34) | <u>MNGP</u>:<br><br>0268, “Fire Protection System Flow Test,” Rev. 15<br><br>1253, “Underground Piping Inspection,” Rev. 4<br><br>1350, “Underground Storage Tank Liquid Level Correlation,” Rev. 6<br><br>1404-01, “EDG ESW Heat Exchanger Performance Test,” Rev. 9<br><br>1435-1, “Underground Storage Tank Monitoring,” Rev. 2<br><br>“T-44 Internal Tank Inspection2,” *No Revision Number*<br><br>I.05.30, “Sampling the Underground Fuel Oil Tanks Monitoring Points,” Rev. 3<br><br>FP-IH-EXC-01, “Excavation and Trenching Controls,” Rev. 0 |
| Bus Duct Inspection Program (MNGP AMP B2.1.6) | Plant-Specific Program (GALL AMP NA) | 4858-48-PM, “2R Transformer and Associated Bus PM,” Rev. 8<br><br>4858-59-PM, “1R Reserve Transformer and Associated Bus Maintenance Procedure,” Rev. 8 |
| BWR Control Rod Drive Return Line Nozzle (MNGP AMP B2.1.7) | BWR Control Rod Drive Return Line Nozzle (GALL AMP XI.M6) | 4 AWI-09.04.00, “Inservice Inspection Licensee Control Program,” Rev. 2<br><br>4 AWI-09.04.03, “ASME Section XI Repair/Replacement Program,” Rev. 6<br><br>4 AWI-07.03.01, “Nondestructive Examination,” Rev. 4<br><br>“Inservice Inspection Examination Plan, Fourth Interval May 1, 2003 through May 31, 2012,” Rev. 2 |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| | | PEI-02.08.03, "Inservice Inspection Flaw Evaluation," Rev. 0 |
| BWR Feedwater Nozzle (MNGP AMP B2.1.8) | BWR Feedwater Nozzle (GALL AMP XI.M5) | 4 AWI-09.04.00, "Inservice Inspection Licensee Control Program," Rev. 2<br><br>4 AWI-09.04.03, "ASME Section XI Repair/Replacement Program," Rev. 6<br><br>4 AWI-07.03.01, "Nondestructive Examination," Rev. 4<br><br>"Inservice Inspection Examination Plan, Fourth Interval May 1, 2003 through May 31, 2012," Rev. 2<br><br>"Chemistry Manual (See Vol. II, Section 5)," Rev. 13<br><br>EWI-09.04.00, "ASME Section XI Inservice Inspection Program," Rev. 0<br><br>PEI-02.08.03, "Inservice Inspection Flaw Evaluation," Rev. 0 |
| BWR Penetrations (MNGP AMP B2.1.9) | BWR Penetrations (GALL AMP XI.M8) | 4 AWI-09.04.00, "Inservice Inspection Licensee Control Program," Rev. 3<br><br>4 AWI-09.04.03, "ASME Section XI Repair/Replacement Program," Rev. 8<br><br>4 AWI-07.03.01, "Nondestructive Examination," Rev. 5<br><br>"Inservice Inspection Examination Plan, Fourth Interval May 1, 2003 through May 31, 2012," Rev. 2<br><br>II.05, "Chemistry Limits and Sampling Frequency," Rev. 15<br><br>EWI-08.01.01, "Boiling Water Reactor Vessel Internals Project (BWRIP) Administrative Manual," Rev. 4 |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| | | EWI-08.01.02, “BWR Implementation Guidelines,” Rev. 1<br><br>EWI-09.04.00, “ASME Section XI Inservice Inspection Program,” Rev. 0<br><br>II.01, “Strategic Chemistry Plan,” Rev. 6<br><br>PEI-02.08.03, “Inservice Inspection Flaw Evaluation,” Rev. 0<br><br>NSP Project E-84N625, “Reactor Vessel Head Nozzle Clad, October, 1984,” Rev. not listed |
| BWR Stress Corrosion Cracking Program (MNGP AMP B2.1.10) | BWR Stress Corrosion Cracking (GALL AMP XI.M7) | <u>MNGP:</u><br><br>4 AWI-09.04.00, “Inservice Inspection Licensee Control Program,” Rev. 3<br><br>4 AWI-07.03.01, “Nondestructive Examination,” Rev. 6<br><br>4 AWI-09.04.03, “ASME Section XI Repair/Replacement Program,” Rev. 5<br><br>“Inservice Inspection Examination Plan, Fourth Interval May 1, 2003 through May 31, 2012,” Rev. 2<br><br>II.05, “Chemistry Limits and Sampling Frequency,” Rev. 15<br><br>EWI-08.01.01, “Boiling Water Reactor Vessel Internals Project (BWRIP) Administrative Manual,” Rev. 4<br><br>EWI-08.01.02, “BWRVIP Implementation Guidelines,” Rev. 1<br><br>EWI-09.04.00, “ASME Section XI Inservice Inspection Program,” Rev. 0<br><br>PEI-02.-8.03, “Inservice Inspection Flaw |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| | | Evaluation," Rev. 0 |
| BWR Vessel ID Attachment Welds (MNGP AMP B2.1.11) | BWR Vessel ID Attachment Welds (GALL AMP XI.M4) | 4 AWI-09.04.00, "Inservice Inspection Licensee Control Program," Rev. 3<br><br>4 AWI-07.03.01, "Nondestructive Examination," Rev. 5<br><br>4 AWI-09.04.03, "ASME Section XI Repair/Replacement Program," Rev. 6<br><br>"Inservice Inspection Examination Plan, Fourth Interval May 1, 2003 through May 31, 2012," Rev. 2<br><br>II.05, " Chemistry Limits and Sampling Frequency," Rev. 15<br><br>EWI-08.01.01, " Boiling Water Reactor Vessel Internals Project (BWRVIP) Administrative Manual," Rev. 4<br><br>EWI-08.01.02, BWRVIP Implementation Guidelines," Rev. 1<br><br>EWI-09.04.00, "ASME Section XI Inservice Inspection Program," Rev. 0<br><br>B.01.01-05, "Operations Manual - Reactor and Vessel Assembly (See Paragraph A.4.D)," Rev. 8<br><br>PEI-02.05.05, "visual Examination of Monticello Reactor Vessel Inspection," Rev. 0<br><br>PEI-02.08.03, "Inservice Inspection Flaw Evaluation," Rev. 0 |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| BWR Vessel Internals (MNGP AMP B2.1.12) | BWR Vessel Internals (GALL AMP XI.M9) | 4 AWI-09.04.00, “Inservice Inspection Licensee Control Program,” Rev. 3<br><br>4 AWI-07.03.01, “Nondestructive Examination,” Rev. 5<br><br>4 AWI-09.04.03, “ASME Section XI Repair/Replacement Program,” Rev. 8<br><br>“Inservice Inspection Examination Plan, Fourth Interval May 1, 2003 through May 31, 2012,” Rev. 2<br><br>EWI-08.01.01, “Boiling Water Reactor Vessel Internals Project Administrative Manual,” Rev. 4<br><br>EWI-08.01.02, “BWRVIP Implementation Guidelines,” Rev. 1<br><br>B.01.01-05, “Operations Manual - Reactor and Vessel Assembly (See Paragraph A.4.d),” Rev. 8<br><br>PEI-02.05.01, “Visual Examination,” Rev. 0<br><br>PEI-02.05.05, “Visual Examination of Monticello Reactor Vessel Inspection,” Rev. 0<br><br>PEI-02.08.03, “Inservice Inspection Flaw Evaluation,” Rev. 0 |
| Closed-Cycle Cooling Water System Program (MNGP AMP B2.1.13) | Closed-Cycle Cooling Water System (GALL AMP XI.M21) | MNGP:<br><br>4 AWI-07.04.02, “ Plant Chemistry Program,” Rev. 3<br><br>II.0.1, “Strategic Chemistry Plan,” Rev. 6<br><br>II.0.3, “Control an Diagnostic Parameters,” Rev. 2<br><br>II.0.5, “Chemistry Limits & Sampling Frequencies,” Rev. 15<br><br>II.14, “Conduct of Chemistry,” Rev. 2 |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| | | I.06.01, "Data Review," Rev. 3<br><br>4131-PM, "RBCCW Heat Exchanger Inspection and Cleaning," Rev. 12<br><br>0137-31, "RBCCW System Isolation Valve Pressure and Local Leak Rate Test," Rev. 11<br><br>0255-13-IA, "RBCCW - Cold Shutdown Valve Operability Tests," Rev. 19<br><br>2017, "Operator Log - Reactor Building," Rev. 49<br><br>0187-01, "11 Emergency Diesel Generator / 11 ESW Quarterly Pump and Valve Tests," Rev. 54<br><br>0187-02, "12 Emergency Diesel Generator / 12 ESW Quarterly Pump and Valve Tests," Rev. 51<br><br>1404-01, "EDG ESW Heat Exchanger Performance Test," Rev. 9<br><br>4107-01-PM, "Emergency Diesel Generator 2 Cycle Maintenance," Rev. 7<br><br>4109-01-PM, "Emergency Diesel Generator 12 Year Maintenance," Rev. 6<br><br>Standing Work Order Numbers 0306614, 0306615, 0306595, 0306596, and 0306659," PM V-AH-4A 18 MONTH, PM V-AH-4B 18MONTH, PM V-AC-10A 18 MONTH, PM V-AC-10B 18 MONTH, and PM V-MZ-1 EVERY TWO YEARS," No Revision Listed<br><br>4160-02-PM, Instrument Air System - 14 Air Compressor K-1D," Rev. 18 |
| Compressed Air Monitoring (MNGP AMP B2.1.14) | Compressed Air Monitoring (GALL AMP XI.M24) | Procedure 1362, "Air Quality Text For the Instrument Air System," Rev. 7<br><br>4159-PM, "Instrument and Service Air Leak Survey, " Rev. 1 |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| | | 4160-01-PM, “ Instrument Air System - 11 Air Compressor K-1A,” Rev. 5<br><br>4160-02-PM, “Instrument Air System - 14 Air Compressor K-1D,” Rev. 15<br><br>4160-03-PM, “Instrument Air System - 13 Air Compressor K-1C,” Rev. 5<br><br>4161-PM, “ Instrument Air System Air Dryers (S-4 and S-75),” Rev. 11<br><br>EWI-01.04.06, “Conduct of System Engineering,” Rev. 7 |
| Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (MNGP AMP B2.1.15) | Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (GALL AMP XI.E1) | <u>MNGP</u>:<br><br>To be developed |
| Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program (MNGP AMP B2.1.16) | Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits (GALL AMP XI.E2) | <u>MNGP</u>:<br><br>7201, “SRM - IRM Detector Replacement,” Rev. 10<br><br>7207, “LRPM Insulation Resistance and Voltage Breakdown Testing,” Rev. 0<br><br>7208, “SRM/IRM Cable Tie-Back Procedure,” Rev. 3<br><br>7758, “SRM/IRM Detector I-V Curve Procedure,” Rev. 0 |
| Fire Protection Program (MNGP AMP B2.1.17) | Fire Protection (GALL AMP XI.M26) | <u>MNGP</u>:<br><br>Operations Manual A.3, “Fire Fighting |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| | | Strategies," Rev. 23<br><br>Operations Manual B.08.05-05, Table A.2.2, "Fire Protection System Operation, Surveillance Requirements," Rev. 28<br><br>Technical Manual NX-16991, "Fire Hazards Analysis," Rev. 11<br><br>Technical Manual NX-17016, "Safe Shutdown Analysis," Rev. 11<br><br>0261, "Fire Pump Exercise and Fuel Quantity Check," Rev. 31<br><br>0265, "Diesel Fire Pump Engine Inspection," Rev. 2<br><br>0266, "Fire Pumps Simulated Auto-Actuation and Capability Test," Rev. 37<br><br>0275-01, "Fire Barrier Penetration seal Visual Inspection," Rev. 10<br><br>0275-02, "Fire Barrier Wall, Damper and Floor Inspection," Rev. 20<br><br>0275-03, "Fire Door Inspections," Rev. 25<br><br>0275-04, "1R 4KV Bus Duct Fire Seals Visual Inspection," Rev. 10<br><br>0275-05, "2R 4KV Bus Duct Fire Seals Visual Inspection, " Rev. 10<br><br>0328, Cable Spreading Room Weekly Check," Rev. 15<br><br>1158-B, "Diesel Fire Pump Weekly Check," Rev. 12<br><br>1216-01, "Fire Door Inspections," Rev. 33<br><br>1385, " Periodic Structural Inspection," Rev. 2 |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| | | 4190-PM, “Diesel Engine, Fire Protection Pump,” Rev. 18<br><br>8053, “Fire Barrier Penetration Sealing and Visual Inspection,” Rev. 21<br><br>8053-01, “Fire Barrier Utility Penetration Sealing,” Rev. 5 |
| Fire Water System Program (MNGP AMP B2.1.18) | Fire Water System (GALL AMP XI.M27) | MNGP:<br><br>0192, “Diesel Fuel Oil Quality Check,” Rev. 18<br><br>0256, “Fire Detection Instrumentation Detector Functional Test,” Rev. 25<br><br>0261, “Electric Fire Pump 15 Minute Run,” Rev. 38<br><br>0266, “Fire Pumps Simulated Auto-Actuation and Capability Test,” Rev. 40<br><br>0267, “Fire Protection System Header Flush,” Rev. 14<br><br>0268, “3 Year fire Protection System Flow Test,” Rev. 15<br><br>0269, “Fire Protection System Valve Check,” Rev. 22<br><br>0270, “Fire Protection System Valve Position Verification,” Rev. 21<br><br>0319, “Fire Protection System - Yard Hydrant Barrel Inspection,” Rev. 14<br><br>0320, “Fire Hose Hydrostatic test - Exterior Hose Stations,” Rev. 14<br><br>0322, “Fire Protection System Sprinkler Header Valve Cycling,” Rev. 22<br><br>0324, “Fire Protection System Sprinkler Nozzle |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| | | Air Flow Tests," Rev. 29<br><br>1078-01, "Fire Protection Main Transformer Deluge Test," Rev. 5<br><br>1078-02, "Fire Protection 2R Transformer and TB Siding Deluge Test," Rev. 5<br><br>1078-03, "Fire Protection 1R Transformer Deluge Test," Rev. 5<br><br>1222, "Control Room Fire Detector Weekly Test," Rev. 5<br><br>1320-01, "Turbine Generator Sprinkler Test," Rev. 3<br><br>1402-31, "Fire Detection Warehouse No. 5," Rev. 4<br><br>1402-34, "Warehouse No. 1/No.2 Fire Suppression," Rev. 7<br><br>1402-35," Fire Detection Instrumentation Guard House/Security Diesel Building," Rev. 10<br><br>1454, "Fire Protection Biocide Injection," Rev. 1<br><br>1471-01, "SAB/MTC fire System Check," Rev. 5<br><br>4057-PM, "Intake Bay/Traveling Screen Forebays Inspection," Rev. 3<br><br>4125-PM, "East Service Water Bay Inspection/Dredging," Rev. 9<br><br>4126-PM, "West Service Water Bay Inspection/Dredging," Rev. 9<br><br>4190-PM, "Diesel engine, Fire Protection Pump," Rev. 18<br><br>4191-PM, "Fire Protection Pump, Diesel Engine Driven," Rev. 3 |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| | | 4213-PM, “Corrosion Monitor Coupon Removal And Installation Procedure,” Rev. 2<br><br>I.05.25, “Zebra Mussel Inspection,” Rev. 0<br><br>I.05.32, “ Sampling of the Non-Oxidizing Biocide Target Systems,” Rev. 3 |
| Flow-Accelerated Corrosion Program (MNGP AMP B2.1.19) | Flow-Accelerated Corrosion (GALL AMP XI.M17) | <u>MNGP</u>:<br><br>CD 5.17, “Flow Accelerated Corrosion and Service Water Inspection Program Standard,” Rev. 1<br><br>FP-PE-FAC-01, “Flow Accelerated Corrosion Inspection Program,” Rev. 1<br><br>EWI 08.05.01, “Flow Accelerated Corrosion Inspection Program (FP-PE-FAC-01),” Rev. 8<br><br>ESM-02.02, “Design Requirements, Practices and Topics (Mechanical),” Rev. 11<br><br>II.01, “Strategic Chemistry Plan,” Rev. 6 |
| Fuel Oil Chemistry Program (MNGP AMP B2.1.20) | Fuel Oil Chemistry (GALL AMP XI.M30) | <u>MNGP</u>:<br><br>Procedure 0192, “ Diesel Fuel Oil Quality Check,” Rev. 18<br><br>MPS 49, “Monticello Fuel Oil Specification,” Rev. 1<br><br>Procedure 1361, “Fuel Transfer from Diesel Oil Storage Tank to Heating Boiler Oil Storage Tank,” Rev. 13<br><br>Procedure 0187-01, “11 Emergency Diesel Generator/ 11 ESW / DOL: Transfer Quarterly Pump And Valve Tests,” Rev. 52<br><br>Procedure 0187-01A, “11 Emergency Diesel Generator/ 11 ESW / DOL Transfer |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| | | Comprehensive Pump And Valve Tests," Rev. 5<br><br>Procedure 0187-01B, "11 Emergency Diesel Generator/ 11 ESW / DOL Transfer Monthly Tests," Rev. 2<br><br>Procedure 0187-02, "12 Emergency Diesel Generator/12 ESW Quarterly Pump And Valve Tests," Rev. 50<br><br>Procedure 0187-02A, "12 Emergency Diesel Generator / 12 ESW Comprehensive Pump And Valve Tests," Rev. 5<br><br>Procedure 0187-02B, "12 Emergency Diesel Generator/ 12 ESW Monthly Pump And Valve Tests," Rev. 2<br><br>Procedure 4190-PM, "Diesel Engine, Fire Protection Pump," Rev. 18<br><br>Procedure 8096, "Fuel Transfer from Diesel Oil Receiving Tank to Diesel Oil Storage Tank," Rev. 5<br><br>Procedure 8095, "Fill Diesel Oil Receiving Tank from Truck," Rev. 14<br><br>OS-08, "Water and Sediment in Petroleum Products," Rev. 5<br><br>OS-02, "API Gravity and Specific Gravity of Petroleum Fluids," Rev. 5 |
| Inaccessible Medium-voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (MNGP AMP B2.1.21) | Inaccessible Medium-voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (GALL AMP XI.E3) | MNGP:<br><br>To be developed. |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| Inspection of Overhead Heavy Load and Light Load Handling Systems Program (MNGP AMP B2.1.22) | Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems (GALL AMP XI.M23) | <u>MNGP</u>:<br><br>4AWI-06.06.01, “Material Handling and Control of Heavy Loads,” Rev. 11<br><br>4245-PM, “Dryer and Steam Separator Sling Lifting Device Inspection Procedure,” Rev. 5<br><br>4250-01PM, “Reactor Building Crane, Bridge Drive System,” Rev. 18<br><br>4250-02PM, “Reactor Building Crane, Trolley Drive System,” Rev. 17<br><br>4250-03PM, “Reactor Building Crane, Main Hoist System,” Rev. 15<br><br>4250 -04PM, “Reactor Building Crane, Auxiliary Hoist System,” Rev. 16<br><br>4260-PM, “Refueling Platform Inspection and Lubrication,” Rev. 19<br><br>4261, “Procedure for Routine Preventive Maintenance of the Fuel Preparation Machine,” Rev. 4<br><br>4270-01PM, “Turbine Building Crane, Bridge Drive System,” Rev. 14<br><br>4270-02PM, “Turbine Building Crane, Trolley Drive System,” Rev. 14<br><br>4270-03PM, “Turbine Building Crane, Main Hoist System,” Rev. 15<br><br>4270-04PM, “Turbine Building Crane, Auxiliary Hoist System,” Rev. 15<br><br>4270-OCD, “Turbine Building Crane,” Rev. 8<br><br>4361-PM, “Reactor Building Crane Inspection Checklist,” Rev. 3<br><br>4864-PM, “Reactor Vessel Head Lifting Device |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| | | Inspection Procedure," Rev. 5<br><br>1131, "Reactor Building Crane," Rev. 10<br><br>8117, "Turbine Maintenance Procedure Heavy Load Movement over Safe Shutdown Equipment on Turbine Floor," Rev. 7<br><br>8151, "Heavy Load Movement Procedure," Rev. 7<br><br>8199, "Generator Rotor Lift & Associated Crane Inspection Procedure," Rev. 4<br><br>9010, "Refueling Platform Daily Inspection and Auxiliary Bridge Inspection," Rev. 14<br><br>9026, "Refueling Bridge Functional Test," Rev. 12 |
| One-Time Inspection Program (MNGP AMP B2.1.23) | One-Time Inspection (GALL AMP XI.M32) | 4 AWI-02.03.03, "Work Procedure Preparation," Rev. 23<br><br>4 AWI-04.05.01, "General Work Controls," Rev. 17<br><br>4 AWI-07.03.01, "Nondestructive Examination," Rev. 5 |
| Open-Cycle Cooling Water System Program (MNGP AMP B2.1.24) | Open-Cycle Cooling Water System Program (GALL AMP XI.M20) | FP-PE-FAC-01, "Flow Accelerated Corrosion Inspection Program," Rev. 1<br><br>FP-PE-SW-01, "Service Water and Fire Protection Inspection Program," Rev. 1<br><br>WEI-08.22.01, "Generic Letter 89-013," Rev. 1<br><br>EWI-08.22.02, "Heat Exchanger Condition Assessment Program," Rev. 1<br><br>Form 3802, "Visual Inspection of Heat Exchanger Condition," Rev. 0<br><br>Form 3590, "Service Water Component |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| | | Inspection, " Rev. 5<br><br>I.05.25, "Zebra Mussel Inspection," Rev. 0<br><br>I.05.29, "Operation of Sodium Hypochlorite System Equipment," Rev. 14<br><br>I.05.31, "Operation of the Non-Oxidizing Biocide System," Rev. 6<br><br>0255-11-III-3, "13 ESW Quarterly Pump and Valve Tests," Rev. 30<br><br>0255-11-III-4, "14 ESW Quarterly Pump and Valve Tests," Rev. 33<br><br>0255-04-IA-1-1, "RHR Loop A Quarterly Pump and Valve Tests," Rev. 64<br><br>0255-04-IA-1-2, "RHR Loop B Quarterly Pump and Valve Tests," Rev. 64<br><br>0187-01, "11 Emergency Diesel Generator / 11ESW / DOL Transfer Quarterly Pump and Valve Tests," Rev. 53<br><br>0187-02, "12 Emergency Diesel Generator / 12ESW Quarterly Pump and Valve Tests," Rev. 51<br><br>1136, "RHR Heat Exchanger Efficiency Test," Rev. 25<br><br>1404-01, "EDG ESW Heat Exchanger Performance Test," Rev. 9<br><br>4056-01-PM, "CRV-EFT V-EAC-14A Condenser Inspection and Cleaning," Rev. 4<br><br>4056-02-PM, "CRV-EFT V-EAC-14 Condenser Inspection and Cleaning," Rev. 4<br><br>4058-01-PM, RHR Pump 11, 13 and Core Spray Pump 11 Motor Cooler chemical Cleaning and Pressure Test," Rev. 10 |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| | | 4058-02-PM, "RHR Pump 12, 14 and Core spray Pump 12 Motor Cooler Chemical Cleaning and Pressure Test," Rev. 8<br><br>4058-03-PM, "RHRSW Pump 11 and 13 Motor Cooler Chemical Cleaning and Pressure Test," Rev. 8<br><br>4058-04-PM, "RHRSW Pump 12 and 14k Motor Cooler Chemical Cleaning and Pressure Test," Rev. 8<br><br>4058-05-PM, "A RHR Room Air Cooling Unit V-AC-5 Internal Cleaning, External Cleaning and Visual Inspection," Rev. 8<br><br>4058-06-PM, "B RHR Room Air Cooling Unit V-AC-4 Internal Cleaning, External Cleaning and Visual Inspection," Rev. 7<br><br>4058-07-PM, "HPCI Room Air Cooling Unit V-AC-8A Internal Cleaning, External Cleaning and Visual Inspection," Rev. 8<br><br>4058-08-PM, "HPCI Room Air Cooling Unit V-AC-8B Internal Cleaning, External Cleaning and Visual Inspection," Rev. 8<br><br>4125-PM, "East Service Water Bay Inspection/Dredging," Rev. 9<br><br>4126-PM, "West Service Water Bay Inspection/Dredging," Rev. 9<br><br>4057-PM, "Intake Bay / Traveling Screen Forebays Inspection," Rev. 3<br><br>4107-01-PM, Emergency Diesel 2 Cycle Maintenance," Rev. 6 |
| Plant Chemistry Program (MNGP AMP B2.1.25) | Water Chemistry (GALL AMP XI.M2) | 4 AWI-07.04.02, " Plant Chemistry Program," Rev. 3<br><br>II.0.1, "Strategic Chemistry Plan," rev. 6 |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| | | II.0.3, “Control and Diagnostic Parameters,” Rev. 2<br><br>II.0.5, “Chemistry Limits & Sampling Frequencies,” Rev. 15<br><br>Section 3.6C/4.6.C, “MNGP Technical Specification,” Rev. Amendment 140a<br><br>II.14, “Conduct of Chemistry,” Rev. 2<br><br>I.06.01, “Data Review,” Rev. 3<br><br>I.06.05, “Inter/Intra Laboratory Results Analysis,” Rev. 4<br><br>II.08, “Chemistry QA/QC Program,” Rev. 20 |
| Primary Containment Inservice Inspection Program (MNGP AMP B2.1.26) | ASME Section XI, Subsection IWE (GALL AMP XI.S1) | N/A, “containment Inspection Examination Plan,” Rev. 0<br><br>PEI-02.05.03, “Visual Examination of Class MC Components (VT-3),” Rev. 0<br><br>PEI-02.05.07, “ Visual Examination (VT-1) of Class MC Components,” Rev. 0<br><br>Proc. 0135, “Pressure-Suppression Chamber Painted Surface Internal Inspection,” Rev. 8<br><br>Proc. 0140, “Drywell Surface Inspection,” Rev. 5<br><br>Proc. 0515, “Primary Containment Visual Examination for Structural Problems,” Rev. 2<br><br>Proc. 1132, “Pressure-Suppression Chamber Internal Structural Visual Inspection,” Rev. 14<br><br>Proc. 1367, “Pressure-Suppression Chamber Below Water Line Painted Surface Internal Inspection,” Rev. 1<br><br>Proc. 1368, “Suppression Chamber External Inspection,” Rev. 2 |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| Protective Coating Monitoring & Maintenance Program (MNGP AMP B2.1.27) | Protective Coating Monitoring & Maintenance Program (GALL AMP XI.S8) | MNGP:<br><br>Procedure 0135, "Pressure-Suppression Chamber Painted Surface Internal Inspection," Rev. 8<br><br>Procedure 0140, "Drywell Interior Surface Inspection," Rev. 5<br><br>Procedure 1367, " Pressure-Suppression Chamber Below Water Line Painted Surface Internal Inspection," Rev. 1 |
| Reactor Head Closure Studs Program (MNGP AMP B.2.1.28) | Reactor Head Closure Studs (GALL AMP XI.M3) | MNGP:<br><br>4 AWI-09.04.00, "Inservice Inspection Licensee Control Program," Rev. 2<br><br>4 AWI-07.03.01, "Nondestructive Examination, " Rev. 4<br><br>4 AWI-09.04.03, " ASME Section XI Repair/Replacement Program," Rev. 6<br><br>*Unnumbered document*, "Inservice Inspection Examination Plan," Rev. 2<br><br>EWI-09.04.00, "ASMe Section XI Inservice Inspection Program," Rev. 0<br><br>PEI-02.05.01, "Visual Examination," Rev. 0<br><br>PEI-02.08.03, "Inservice Inspection Flaw Evaluation," Rev. 0<br><br>PEI-02.03.06, "Ultrasonic Examination of Bolts and Studs to Appendix VII," Rev. 0 |
| Reactor Vessel Surveillance (MNGP AMP B2.1.29) | Reactor Vessel Surveillance (GALL AMP XI.M31) | To be documented. |
| Selective Leaching (MNGP AMP B2.1.30) | Selective Leaching of | This Table to be developed with the program. |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| | Materials (GALL AMP XI.M33) | |
| Structures Monitoring Program (MNGP AMP B2.1.31) | Masonry Wall Program (GALL AMP XI.S5); Structures Monitoring Program (GALL AMP XI.S6); RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants (GALL AMP XI.S7) | EWI-05.02.01, “ Monticello Maintenance Rule Program Document,” Rev. 7<br><br>Procedure 1385, “Periodic Structural Inspection,” Rev. 3<br><br>Procedure 1396, “Equipment/Structures Settling Check,” rev/ 2<br><br>Procedure 4125-PM, “East Service Water Bay Inspection/Dredging,” Rev. 9<br><br>Procedure 4126-PM, “West Service Water Bay Inspection/Dredging,” Rev. 9 |
| Systems Condition Monitoring Program (MNGP AMP B2.1.32) | Plant-Specific Program (GALL AMP NA) | EWI-01.04.06, “conduct of System Engineering,” Rev. 7<br><br>“System Walkdown Guideling per the MNGP Engineering Web Page,” Rev. N/A |
| Thermal Aging & Neutron Irradiation Embrittlement of CASS Program (MNGP AMP B2.1.33) | Thermal Aging & Neutron Irradiation Embrittlement of CASS (GALL AMP XI.M13) | 4 AWI-09.04.00, “Inservice Inspection Licensee Control Program,” Rev. 2<br><br>4 AWI-07.03.01, “Nondestructive Examination, “ Rev. 4<br><br>“Inservice Inspection Examination Plan,” Rev. 2<br><br>EWI-08.01.01, “Boiling Water Reactor Vessel Internals Project Administrative Manual,” Rev. 2<br><br>EWI-08.01.02, “BWRVIP Implementation Guidelines,” Rev. 1<br><br>EWI-09.04.00, “ASME Section XI Inservice Inspection Program,” Rev. 0 |
| Metal Fatigue of Reactor Coolant | Metal Fatigue of Reactor Coolant | Fleet Proc. CD 5.24, “ Reactor Vessel Integrity Program Standard,” Rev. 0 |

| MNGP Aging Management Program | Corresponding GALL Aging Management Program | MNGP AMP Basis Document and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|---|
| Pressure Boundary TLAA (MNGP AMP B3.2) | Pressure Boundary TLAA (GALL AMP X.M1) | MNGP EWI-08.07.01, "Thermal Fatigue Monitoring Program," Rev. 0<br><br>MNGP Proc. 1475, "Equipment Cycles Surveillance," Rev. 1 |
| Environmental Qualification (EQ) Program - TLAA (MNGP AMP B3.1) | Environmental Qualification (EQ) of Electrical Components (GALL AMP X.E1) | CD5.11, "Corp. Directive - Equipment Environmental Qualification Standard," Rev. 1<br><br>4 AWI-08.11.01, "Admin. Work Instr. - Environmental Qualification," Rev. 2<br><br>EWI-08.11.01, "Engrg. Work Instr. - Equipment Qualification User's Manual," Rev. 11 |

| LRA Section Documenting AMR Results | MNGP Aging Management Review Technical Report and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|
| Section 3.1, Aging Management of Reactor Coolant System | AMR-RHV, Reactor Head Vent System, Revision 1<br><br>AMR-REC, Reactor Recirculation System, Revision 2<br><br>AMR-RVI, Reactor Vessel Instrumentation System, Revision 1<br><br>GENE 0000-0021-9219-01, AMR for Reactor Pressure Vessel, Revision 0<br><br>GENE 0000-0023-5191-01, AMR for Reactor Internals, Revision 0<br><br>Operating Experience (OE) Review Output Report for Reactor Heat Vent System (OE-RHV), Revision 0<br><br>OE Review Output Report for Reactor Recirculation System, Rev. 0<br><br>OE Review Output Report for Reactor Vessel Instrumentation System, Revision 0<br><br>OE Review Output Report for Reactor Pressure Vessel, Revision 0<br><br>OE Review Output Report for Reactor Pressure Vessel Internals, Revision 0<br><br>NRC Letter dated November 3, 2003, “Proposed Interim Staff Guidance (ISG)-12: Addition of Generic Aging Lessons Learned (GALL) Aging Management Program (AMP) XI.M35, “One-Time Inspection of Small-Bore Piping,” for License Renewal<br><br>MNGP Calculation Package, File No. NMC-01-301, “Degradation Mechanisms Evaluation for Class 1 and 2 Piping Welds at Monticello Generating Plant (MNGP),” Revision 1.<br><br>MNGP Procedure MPS-1010, Piping Materials, Classification and Standards for the MNGP, Revision 18.<br><br>MNGP P&IDs:<br>Nuclear Boiler System – Steam Supply; NH-36241, Rev. BB<br>HPCI System – Steam Side; NH-36249, Rev. AM<br>RCIC System – Steam Side; NH-36251, Rev. AQ<br>RWCU System; NH-36254, Rev. AW<br>SLC System; NH-36253, Rev. W |
| Section 3.2, Aging Management of Engineered | AMR-APR, Automatic Pressure Relief System, Revision 1<br><br>AMR-CGC, Combustible Gas Control System, Revision 2 |

| LRA Section Documenting AMR Results | MNGP Aging Management Review Technical Report and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|
| Safeguards Features | AMR-CSP, Core Spray System, Revision 1<br><br>AMR-HPC, High Pressure Coolant Injection System, Revision 2<br><br>AMR-PCM, Primary Containment Mechanical System, Revision 2<br><br>AMR-RCI, Reactor Coolant Isolation System, Revision 1<br><br>AMR-RHR, Residual Heat Removal System, Revision 2<br><br>AMR-SCT, Secondary Containment System, Revision 2<br><br>OE Review Output Report for Automatic Pressure Relief System, Rev. 0<br><br>OE Review Output Report for Combustible Gas Control System, Revision 0<br><br>OE Review Output Report for Core Spray System, Revision 0<br><br>OE Review Output Report for High Pressure Coolant Injection System, Revision 0<br><br>OE Review Output Report for Primary Containment Mechanical System, Revision 0<br><br>OE Review Output Report for Reactor Coolant Isolation System, Revision 0<br><br>OE Review Output Report for Residual Heat Removal System, Revision 0<br><br>OE Review Output Report for Secondary Containment System, Revision 0<br><br>Program Basis Document/Aging Management Program (PBD/AMP) -03 ASME Section XI, ISI Subsections IWB, IWC, IWD, Revision 1, Dated 2/12/05<br><br>Ultrasonic Examination of Ferritic Piping Welds to Appendix VIII, PEI-02.0.01, Revision 0, Dated 4/25/03<br><br>MNGP Procedure MPS-1010, Piping Materials, Classification and Standards for the MNGP, Revision 18. |

| LRA Section Documenting AMR Results | MNGP Aging Management Review Technical Report and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|
| | PBD/AMP-019, One-Time Inspection Program, Revision 1, 3/10/05<br><br>PBD/AMP-008, Closed-Cycle Cooling Water System, Revision 1, 2/04/05<br><br>PBD/AMP-038, BWR Stress Corrosion Cracking, Revision 2, 4/08/03<br><br>EPRI Closed Cooling Water Chemistry Guideline, EPRI-TR-107396, October, 1997<br><br>Metals Handbook, Volume 13, Corrosion, American Society for Metals, 1987<br><br>MNGP Technical Report, Mechanical Engineered Safety Features Systems - Comparison to NUREG-1801, TR-016, Revision 1, 3/07/05<br><br>NUREG-1801, Vol. 2, Generic Aging Lessons Learned (GALL) Report, Volume 2, July 2001 |
| Section 3.3, Aging Management of Auxiliary Systems | Program Basis Document/Aging Management Program (PBD/AMP) -010 Inspection of Overhead Heavy Load & Light Load (Related to Refueling) Handling Systems, Revision 1 Dated 1/5/05<br><br>PBD/AMP-017, Fuel Oil Chemistry Program, Revision 1, 2/8/05<br><br>PBD/AMP-019, One-Time Inspection Program, Revision 1, 3/10/05<br><br>PBD/AMP-029, Protective Coating Monitoring & Maintenance Program Rev. 1, 12/17/04<br><br>L-MT-05-052, Response to Request for Additional Information and Submittal of Additional Information in Support of the Monticello License Renewal Application (TAC No. MC6440), 6/10/05<br><br>Letter, Larson to Director, NRR, Response to NRC Bulletin No. 88-08, <u>Thermal Stresses in Piping Connected to Reactor Coolant Systems</u> 9/2/88<br><br>Letter, Parker to Director, NRR Supplementary Response to NRC Bulletin No. 88-08, <u>Thermal Stresses in Piping Connected to Reactor Coolant Systems</u> 5/21/90<br><br>19971907, Assessment for Issue Number 19971907 |

| LRA Section Documenting AMR Results | MNGP Aging Management Review Technical Report and Other Documents Reviewed in Addition to MNGP LRA |
|---|---|
| | GL 98-04, Response to Generic Letter 98-04, Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System After a Loss-of-Coolant Accident Because of Construction and Protective Coating Deficiencies and Foreign Material in Containment, 11/11/98<br><br>MNGP Procedure 0135, Pressure Suppression Chamber Painted Surface Internal Inspection, Rev. 8, 8/31/89<br><br>MNGP Procedure 0140, Drywell Interior Surface Inspection, Rev. 5, 8/31/89<br><br>MNGP Procedure 1367, Pressure Suppression Chamber Below Water Line Painted Surface Internal Inspection, Rev.1, 8/31/89<br><br>Drawing Number NX-9005-36-1, 85/5 Ton Crane, Revision B<br><br>MNGP Calculation CA-01-156, IWE Recording Criteria, Rev.0, dated 11/13/01<br><br>ASTM D 5163, Established Procedures to Monitor that Performance of Safety Related Coatings in an Operating Nuclear Plant, 1996<br><br>NUREG-1801, Vol. 2, Generic Aging Lessons Learned (GALL) Report, Volume 2, July 2001 |

**Attachment 6**
**List of Commitments to Be Included in Appendix A of the Safety Evaluation Report**

In responses to project team questions (as documented in letters dated August 11, 2005 [ML052280269] and August 31, 2005 [ML052500294]), the applicant clarified several MNGP LRA commitments, revised several MNGP LRA commitments, and corrected several technical errors in the MNGP LRA. The information provided in these responses either augments or supersedes (where applicable) the information provided in the applicant's MNGP LRA submittal.

| Audit Question No. | Audit Report Section(s) | Commitment(s) |
|---|---|---|
| 3.1-18 | 3.1.2.1.1 | Revise the "Discussion" in LRA Table 3.1.1, Item Number 3.1.1-23, to read, "Cast Austenitic Stainless Steel (CASS) components in the Engineered Safety Feature (ESF) systems subject to an environment that supports loss of fracture toughness due to thermal aging embrittlement were assigned the American Society of Mechanical Engineers (ASME) Section Xi Inservice Inspection, Subsections IWB, IWC, and IWD Program. Those CASS components that are subject to this aging effect/mechanism are valves."<br><br>This change to the text of the LRA will be summarized in the first Annual LRA Supplement. |
| B2.1.26-01 | 2.2.2 | Revise LRA Appendix B2.1.2, ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD:<br><br>1. Identify the following MNGP ASME Section XI Program approved alternatives as exceptions to NUREG-1801:<br><br>• Use of MNGP's Risk Informed Inservice Inspection Plan;<br>• Reactor Vessel Stabilizer Brackets' Inspection Relief;<br>• Use of 2001 Edition for Repair/Replacement Program;<br>• Use of Code Case N-613-1;<br>• Use of Code Case N-307-2;<br>• Use of code Case N-526.<br><br>2. Under "NUREG-1801 Consistency" delete the statement, "Exceptions to ASME Code requirements that have been granted by approved Code Cases or relief requests, or modifications by 10 CFR 50.55a are not considered to be exceptions to NUREG-1801 criteria".<br><br>3. Under "Corrective Actions" delete the words "and approved NRC relief requests."<br>These changes to the text of the LRA will be summarized in the first Annual LRA Supplement. |

| Audit Question No. | Audit Report Section(s) | Commitment(s) |
|---|---|---|
| B2.1.26-01 | 2.3.3 | Revise LRA Appendix B2.1.3, ASME Section XI, Subsection IWF:<br><br>Identify the following MNGP ASME Section XI Program approved alternative as exceptions to NUREG-1801:<br><br>• Use of Code Case N-491-2.<br><br>This change to the text of the LRA will be summarized in the first Annual LRA Supplement. |
| B2.1.26-01 | 2.4 to be provided by DE | Revise LRA Appendix B2.1.4, Bolting Integrity:<br><br>1. Identify the following MNGP ASME Section XI Program approved alternative as an exception to NUREG-1801:<br><br>• Use of 2001 Edition for Repair/Replacement Program.<br><br>2. Under the "Detection of Aging Effects" delete the words "except as allowed by code cases, relief requests, or interpretations."<br><br>3. Under the "Corrective Actions" delete the words "per a previously approved ISI Relief Request."<br><br>4. Under "Monitoring and Trending" delete the words "risk-informed methodology."<br><br>These changes to the text of the LRA will be summarized in the first Annual LRA Supplement. |
| B2.1.26-01 | 2.7.3 | Revise LRA Appendix B2.1.7, BWR Control Rod Drive Return Line Nozzle:<br><br>Identify the following MNGP ASME Section XI Program approved alternative as an exception to NUREG-1801:<br><br>• Use of 2001 Edition for Repair/Replacement Program.<br><br>This change to the text of the LRA will be summarized in the first Annual LRA Supplement. |
| B2.1.26-01 | 2.8.3 | Revise LRA Appendix B2.1.8, BWR Feedwater Nozzle:<br><br>Identify the following MNGP ASME Section XI Program approved alternative as an exception to NUREG-1801: |

| Audit Question No. | Audit Report Section(s) | Commitment(s) |
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| | | • Use of 2001 Edition for Repair/Replacement Program.<br><br>This change to the text of the LRA will be summarized in the first Annual LRA Supplement. |
| B2.1.26-01 | 2.9.3 | Revise LRA Appendix B2.1.9, BWR Penetrations:<br><br>1. Identify the following MNGP ASME Section XI Program approved alternatives as exceptions to NUREG-1801:<br><br>• Use of MNGP's Risk Informed Inservice Inspection Plan;<br>• Use of Code Case N-613-1.<br><br>2. Under "Program Description" delete the words "with approved ISI Relief Requests."<br><br>These changes to the text of the LRA will be summarized in the first Annual LRA Supplement. |
| B2.1.26-01 | 2.10.2 & 2.10.3 | Revise LRA Appendix B2.1.10, BWR Stress Corrosion Cracking:<br><br>1. Identify the following MNGP ASME Section XI Program approved alternative as an exception to NUREG-1801:<br><br>• Use of 2001 Edition for Repair/Replacement Program.<br><br>2. Under "Program Description" delete the words "and the Risk-Informed ISI Program."<br><br>3. Under "Detection of Aging Effects" delete the words "and RI-ISI."<br><br>4. Under "Monitoring and Trending" delete the words "and the RI-ISI Program."<br><br>These changes to the text of the LRA will be summarized in the first Annual LRA Supplement. |
| B2.1.26-01 | 2.11.2 | Revise LRA Appendix B2.1.11, BWR Vessel ID Attachment Welds:<br><br>1. Identify the following MNGP ASME Section XI Program approved alternative as an exception to NUREG-1801:<br><br>• Use of 2001 Edition for Repair/Replacement Program. |

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| | | 2. Under “Program Description” delete the words “and approved ISI Relief Requests.”<br><br>These changes to the text of the LRA will be summarized in the first Annual LRA Supplement. |
| B2.1.26-01 | 2.12.2 | Revise LRA Appendix B2.1.12, BWR Vessel Internals:<br><br>Under “Program Description” delete the words “and approved ISI Relief Requests.”<br><br>This change to the text of the LRA will be summarized in the first Annual LRA Supplement. |
| B2.1.19-05 | 2.19.2 | The NMC fleet procedure for the Flow Accelerated Corrosion Inspection Program will be revised to include the accepted 87.5% of nominal pipe wall thickness for nonsafety-related piping as a trigger point for engineering analysis. This action is entered and being tracked in the NMC corrective action process.<br><br>This commitment will be documented in the first Annual LRA Supplement. |
| B2.1.26-01 | 2.26.2 | Revise LRA Appendix B2.1.16, Primary Containment Inservice Inspection Program:<br><br>Revise the LRA to identify the following items in the B2.1.26 Primary Containment Inservice Inspection Program:<br><br>The following statements are not required because ASME Section XI, Subsection IWE alternatives expire prior to the period of extended operation:<br><br>Under "NUREG-1801 Consistency" delete the statement, "Exceptions to ASME Code requirements that have been granted by approved Code Cases or relief requests are not considered to be exceptions to NUREG-1 801 criteria."<br><br>Under "Scope of Program" delete the statement, "These are not considered exceptions since the MNGP program has been reviewed by the NRC and is in accordance with 10 CFR 50.55a with NRC approved relief requests."<br><br>Under "Parameters Monitored or Inspected” delete the |

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| | | statement, "These are not considered exceptions since the MNGP program has been reviewed by the NRC and is in accordance with 10 CFR 50.55a with NRC approved relief requests."<br><br>Under "Detection of Aging Effects" delete the statement, “This is not considered an exception since the MNGP program has been reviewed by the NRC and is in accordance with 10 CFR 50.55a with NRC approved relief requests."<br><br>Under "Monitoring and Trending" delete the statement, "This is not considered an exception since the MNGP program has been reviewed by the NRC and is in accordance with 10 CFR 50.55a with NRC approved relief requests."<br><br>Under "Corrective Actions" delete the statement, "This is not considered an exception since the MNGP program has been reviewed by the NRC and is in accordance with 10 CFR 50.55a with NRC approved relief requests."<br><br>Under "Confirmation Process" delete the statement, "This is not considered an exception since the MNGP program has been reviewed by the NRC and is in accordance with 10 CFR 50.55a with NRC approved relief requests."<br><br>These changes to the text of the LRA will be summarized in the first Annual LRA Supplement. |
| B2.1.27-04 | 2.27.4 | The inspectors who perform the periodic inspections are qualified to plant procedures and acceptance criteria. However, they are not necessarily qualified to ASTM Guide D4537 or ANSI N45.2.6.<br><br>Prior to the period of extended operation, coating inspectors will meet the requirements of ANSI N45.2.6.<br><br>This commitment will be documented in the first Annual LRA Supplement. |