SECTION 3

AGING MANAGEMENT REVIEW RESULTS

This section of the SER contains the staff's evaluation of the applicant's aging management programs (AMPs) and aging management reviews (AMRs). In LRA Appendix B, the applicant described the 35 AMPs that it relies on to manage or monitor the aging of long-lived, passive components and structures.

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

3.0 Applicant's Use of the Generic Aging Lessons Learned Report

In preparing its LRA, Nuclear Management Company, LLC (NMC or the applicant) credited the GALL Report. The GALL Report contains the staff's generic evaluation of the existing plant programs, and it documents the technical basis for determining where existing programs are adequate without modification, and where existing programs should be augmented for the extended period of operation. The evaluation results documented in the GALL Report indicate that many of the existing programs are adequate to manage the aging effects for particular structures or components for license renewal without change. The GALL Report also contains recommendations on specific areas for which existing programs should be augmented for license renewal. An applicant may reference the GALL Report in its LRA to demonstrate that the programs at its facility correspond to those reviewed and approved in the Report.

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

The GALL Report identifies: (1) systems, structures, and components (SSCs); (2) structure and component (SC) materials; (3) the environments to which the SCs are exposed; (4) the aging effects associated with the materials and environments; (5) the AMPs that are credited with managing or monitoring the aging effects; and (6) recommendations for further applicant evaluations of aging management for certain component types.

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

In addition to its review of the LRA, the staff conducted an onsite audit of selected aging management reviews and associated aging management programs, as described in the "Audit and Review Plan for Plant Aging Management Reviews and Programs for Monticello Nuclear Generating Plant," dated June 2, 2005 (ADAMS ML051600008). The onsite audits and reviews are designed to maximize the efficiency of the staff's review of the LRA. The need for formal correspondence between the staff and the applicant is reduced, and the result is an improvement in the review's efficiency. Also, the applicant could respond to questions and the staff could readily evaluate the applicant's responses.

3.0.1 Format of the License Renewal Application

The applicant submitted an application that followed the standard LRA format, as agreed to between the NRC staff and the Nuclear Energy Institute (NEI) (see letter dated April 7, 2003, ML030990052). This revised LRA format incorporates lessons learned from the staff's reviews of the previous five LRAs. These previous applications used a format developed from information gained during an NRC staff and NEI demonstration project that was conducted to evaluate the use of the GALL Report in the staff's review process.

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

- Table 1: Table 3.x.1 – where "3" indicates the LRA section number, "x" indicates the sub-section number from the GALL Report, and "1" indicates that this is the first table type in LRA Section 3.

- Table 2: Table 3.x.2-y – where "3" indicates the LRA section number, "x" indicates the sub-section number from the GALL Report, "2" indicates that this is the second table type in LRA Section 3, and "y" indicates the system table number.

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

3.0.1.1 Overview of Table 1

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

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

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

3.0.1.2 Overview of Table 2

Table 3.x.2-y (Table 2) provides the detailed results of the AMRs for those components identified in LRA Section 2 as being subject to an AMR. The LRA contains a Table 2 for each of the systems or components 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 the core spray system, high pressure coolant injection system, and residual heat removal system, Table 2 consists of the following nine columns:

(8) Component Type – The first column identified the component types from LRA Section 2 that are subject to aging management review. The component types are listed in alphabetical order.

(9) Intended Function – The second column contains the license renewal intended functions for the listed component types. Definitions of intended functions are contained within LRA Table 2.1-1.

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

(11) Environment – The fourth column lists the environment to which the component types are exposed. Internal and external service environments are indicated and a list of these environments is provided in LRA Tables 3.0-1 and 3.0-2.

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

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

(14) NUREG-1801 Volume 2 Line Item – The seventh column lists the GALL Report item(s) that the applicant identified as being similar to the AMR results in the LRA. The applicant compared each combination of component type, material, environment, aging effect requiring management, and aging management program in Table 2 of the LRA to the items in the GALL Report. If there were no corresponding items in the GALL Report, the applicant left the column blank. In this way, the applicant identified the AMR results in the LRA tables that corresponded to the items in the GALL Report tables.

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

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

3.0.2 Staff's Review Process

The staff conducted the following three types of evaluations of the AMRs and associated AMPs:

(8) For items that the applicant stated were consistent with the GALL Report, the staff conducted either an audit or a technical review to determine consistency with the GALL Report.

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

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

The staff performed audits and technical reviews of the applicant's AMPs and AMRs. These audit and technical reviews determine whether the effects of aging on structures and components can be adequately managed so that their intended functions can be maintained consistently with the plant's current licensing basis (CLB) for the period of extended operation, as required by 10 CFR Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

3.0.2.1 Review of AMPs

For those AMPs for which the applicant claimed consistency with the GALL AMPs, the staff conducted either an audit or a technical review to verify that the applicant's AMPs were

consistent with the AMPs in the GALL Report. For each AMP that had one or more deviations, the staff evaluated each deviation to determine: (1) whether the deviation was acceptable; and (2) whether the AMP, as modified, would adequately manage the aging effect(s) for which it was credited. For AMPs that were not evaluated in the GALL Report, the staff performed a full review to determine the adequacy of the AMPs. The staff evaluated the AMPs against the following 10 program elements defined in SRP-LR Appendix A.

(1) Scope of the Program – Scope of the program should include the specific structures and components subject to an AMR for license renewal.

(2) Preventive Actions – Preventive actions should prevent or mitigate aging degradation.

(3) Parameters Monitored or Inspected – Parameters monitored or inspected should be linked to the degradation of the particular structure or component intended 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 a timely detection of aging effects.

(5) Monitoring and Trending – Monitoring and trending should provide predictability of the extent of degradation, as well as timely corrective or mitigative actions.

(6) Acceptance Criteria – Acceptance criteria, against which the need for corrective action will be evaluated, should ensure that the structure or component intended function(s) are maintained under all CLB design conditions during the period of extended operation.

(7) Corrective Actions – Corrective actions, including root cause determination and prevention of recurrence, should be timely.

(8) Confirmation Process – Confirmation process should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective.

(9) Administrative Controls - Administrative controls should provide a formal review and approval process.

(10) Operating Experience – Operating experience of the 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.

Details of the staff's audit evaluation of program elements (1) through (6) are documented in the MNGP audit and review report and are summarized in Section 3.0.3 of this SER.

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

The staff reviewed the information concerning the (10) operating experience program element and documented its evaluation in the MNGP audit and review report. The staff also included a summary of the program element in Section 3.0.3 of this SER.

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

3.0.2.2 Review of AMR Results

Table 2 of the LRA contains information concerning whether or not the AMRs align with the AMRs identified in the GALL Report. For a given AMR in Table 2, the staff reviewed the intended function, material, environment, aging effect requiring management, and aging management program (MEAP) combination for a particular component type within a system. The AMRs that correlate between a combination in Table 2 and a combination in the GALL Report were identified by a referenced item number in column seven, "NUREG-1801 Volume 2 Line Item." The staff also conducted onsite audits to verify the correlation. A blank column seven indicates that the applicant was unable to locate an appropriate corresponding combination in the GALL Report. The staff conducted a technical review of these combinations that were not consistent with the GALL Report. The next column, "Table 1 Item," provided a reference number that indicated the corresponding row in Table 1.

3.0.2.3 USAR Supplement

Consistent with the SRP-LR, for the AMRs and associated AMPs that it reviewed, the staff also reviewed the 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).

3.0.2.4 Documentation and Documents Reviewed

In performing its review, the staff relied heavily on the LRA, the LRA supplements, the SRP-LR, and the GALL Report.

Also, during the onsite audit, the staff examined the applicant's justification, as documented in the staff's MNGP audit and review report, to verify that the applicant's activities and programs will adequately manage the effects of aging on SSCs. The staff also conducted detailed discussions and interviews with the applicant's license renewal project personnel and others with technical expertise relevant to aging management.

3.0.3 Aging Management Programs

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

Table 3.0.3-1 MNGP's Aging Management Programs

MNGP's AMP (LRA Section)	GALL Comparison	GALL AMP(s)	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Existing AMPs				
10 CFR 50, Appendix J Program (B2.1.1)	Consistent with exceptions	XI.S4	containments, structures, and component supports	3.0.3.2.1
ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2)	Consistent with exception	XI.M1	reactor coolant system, engineered safety features	3.0.3.2.2
ASME Section XI, Subsection IWF Program (B2.1.3)	Consistent with enhancement	XI.S3	containments, structures, and component supports	3.0.3.2.3
Bolting Integrity Program (B2.1.4)	Consistent with enhancements	XI.M18	reactor coolant system, engineered safety features, auxiliary systems, steam and power conversion system	3.0.3.2.4
Buried Piping & Tanks Inspection Program (B2.1.5)	Consistent with enhancements	XI.M34	engineered safety features; auxiliary systems; containments, structures, and component supports	3.0.3.2.5
BWR Control Rod Drive Return Line Nozzle Program (B2.1.7)	Consistent with exceptions	XI.M6	reactor coolant system	3.0.3.2.6
BWR Feedwater Nozzle Program (B2.1.8)	Consistent with enhancements	XI.M5	reactor coolant system	3.0.3.2.7
BWR Penetrations Program (B2.1.9)	Consistent with exceptions	XI.M8	reactor coolant system	3.0.3.2.8
BWR Stress Corrosion Cracking Program (B2.1.10)	Consistent with exception	XI.M7	reactor coolant system, engineered safety features, auxiliary systems	3.0.3.2.9
BWR Vessel ID Attachment Welds Program (B2.1.11)	Consistent with exception	XI.M4	reactor coolant system	3.0.3.2.10
BWR Vessel Internals Program (B2.1.12)	Consistent with exception and enhancement	XI.M9	reactor coolant system	3.0.3.2.11

MNGP's AMP (LRA Section)	GALL Comparison	GALL AMP(s)	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Closed-Cycle Cooling Water System Program (B2.1.13)	Consistent with exceptions and enhancement	XI.M21	engineered safety features, auxiliary systems	3.0.3.2.12
Compressed Air Monitoring Program (B2.1.14)	Consistent with exceptions and enhancements	XI.M24	auxiliary systems	3.0.3.2.13
Fire Protection Program (B2.1.17)	Consistent with exception and enhancement	XI.M26	auxiliary systems; containments, structures, and component supports	3.0.3.2.15
Fire Water System Program (B2.1.18)	Consistent with enhancement	XI.M27	auxiliary systems	3.0.3.2.16
Flow-Accelerated Corrosion Program (B2.1.19)	Consistent	XI.M17	reactor coolant system, engineered safety features, auxiliary systems, steam and power conversion system	3.0.3.1.2
Fuel Oil Chemistry Program (B2.1.20)	Consistent with exceptions and enhancements	XI.M30	auxiliary systems	3.0.3.2.17
Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program (B2.1.22)	Consistent with exception and enhancement	XI.M23	containments, structures, and component supports	3.0.3.2.18
Open-Cycle Cooling Water System Program (B2.1.24)	Consistent	XI.M20	engineered safety features, auxiliary systems, steam and power conversion system	3.0.3.1.5
Plant Chemistry Program (B2.1.25)	Consistent with exceptions	XI.M2	reactor coolant system, engineered safety features, auxiliary systems, steam and power conversion system	3.0.3.2.19
Primary Containment In-Service Inspection Program (B2.1.26)	Consistent	XI.S1	containments, structures, and component supports	3.0.3.1.6
Protective Coating Monitoring & Maintenance Program (B2.1.27)	Consistent with enhancements	XI.S8	containments, structures, and component supports	3.0.3.2.20
Reactor Head Closure Studs Program (B2.1.28)	Consistent	XI.M3	reactor coolant system	3.0.3.1.7
Reactor Vessel Surveillance Program (B2.1.29)	Consistent with enhancement	XI.M31	reactor coolant system	3.0.3.2.21

MNGP's AMP (LRA Section)	GALL Comparison	GALL AMP(s)	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Structures Monitoring Program (B2.1.31)	Consistent with enhancements	XI.S6	containments, structures, and component supports	3.0.3.2.23
System Condition Monitoring Program (B2.1.32)	Plant-specific		reactor coolant system; engineered safety features; auxiliary systems; steam and power conversion system; containments, structures, and component supports	3.0.3.3.2
Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program (B2.1.33)	Consistent	XI.M13	reactor coolant system	3.0.3.1.8
Electrical Equipment Subject to 10 CFR 50.49 Environmental Qualification (EQ) Requirements Program (B3.1)	Consistent	X.E1	electrical and instrumentation and controls	3.0.3.1.9
Metal Fatigue of the Reactor Coolant Pressure Boundary Program (B3.2)	Consistent with enhancement	X.M1	reactor coolant system, engineered safety features	3.0.3.2.24
New AMPs				
Bus Duct Inspection Program (B2.1.6)	Plant-specific		electrical and instrumentation and controls	3.0.3.3.1
Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B2.1.15)	Consistent	XI.E1	electrical and instrumentation and controls	3.0.3.1.1
Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program (B2.1.16)	Consistent with exceptions	XI.E2	electrical and instrumentation and controls	3.0.3.2.14

MNGP's AMP (LRA Section)	GALL Comparison	GALL AMP(s)	LRA Systems or Structures That Credit the AMP	Staff's SER Section
Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program (B2.1.21)	Consistent	XI.E3	electrical and instrumentation and controls	3.0.3.1.3
One-Time Inspection Program (B2.1.23)	Consistent	XI.M32	reactor coolant system, engineered safety features, auxiliary systems, steam and power conversion system	3.0.3.1.4
Selective Leaching of Materials Program (B2.1.30)	Consistent with exception	XI.M33	engineered safety features, auxiliary systems, steam and power conversion system	3.0.3.2.22

3.0.3.1 AMPs that are Consistent with the GALL Report

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

- Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B2.1.15)
- Flow-Accelerated Corrosion Program (B2.1.19)
- Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program (B2.1.21)
- One-Time Inspection Program (B2.1.23)
- Open-Cycle Cooling Water System Program (B2.1.24)
- Primary Containment In-Service Inspection Program (B2.1.26)
- Reactor Head Closure Studs Program (B2.1.28)
- Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program (B2.1.33)
- Electrical Equipment Subject to 10 CFR 50.49 Environmental Qualification (EQ) Requirements Program (B3.1)

3.0.3.1.1 Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

<u>Summary of Technical Information in the Application</u>. In LRA Section B2.1.15, the applicant described the Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program, stating that this is a new program that is consistent with GALL AMP XI.E1, "Electrical Cables and Connections Not Subject to 10 CFR 50.49

Environmental Qualification Requirements.” An adverse localized environment is a condition in a limited plant area that is significantly more severe than the specified service environment for the component. An adverse variation in environment is significant if it could appreciably increase the rate of aging of a component or have an immediate adverse effect on operability. In most areas of the plant, the actual ambient environments (e.g., temperature, radiation, or moisture) are less severe than the plant design environment. However, in a limited number of localized areas, the actual environments may be more severe than the plant design environment for those areas. Cable and connection insulation materials may degrade more rapidly than expected in these adverse localized environments. Since they are not subject to the environmental qualification requirements of 10 CFR 50.49, the electrical cables and connections covered by this aging management program are either not exposed to harsh accident conditions or are not required to remain functional during or following an accident to which they are exposed. The scope of this program includes accessible non-EQ electrical cables and connections, including control and instrumentation circuits, within the scope of license renewal.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff’s MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.E1.

The staff reviewed those portions of the MNGP AMP B2.1.15, “Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program," which the applicant claims are consistent with GALL AMP XI.E1,“ Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant’s AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant’s LRA AMP acceptable because it conformed to the recommended GALL Report AMP.

Operating Experience. In LRA Section B2.1.15, the applicant explained that the Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program is a new site-specific program and therefore does not have any operating experience. 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 staff 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 Institute of Nuclear Power Operations (INPO), Licensing Information Service (LIS), NMC Fleet, NRC, and Part 21 issues. The staff reviewed the applicant's response and determined that it is acceptable.

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

<u>USAR Supplement</u>. In LRA Section A2.1.15, the applicant provided the USAR supplement for the Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program.

Subsequently, by letter dated June 10, 2005, 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 staff reviewed this section and determined that the information in the USAR supplement as augmented by the LRA supplement provided an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.1.2 Flow-Accelerated Corrosion Program

<u>Summary of Technical Information in the Application</u>. In LRA Section B2.1.19, the applicant described the Flow-Accelerated Corrosion Program, stating that this is an existing program that is consistent with GALL AMP XI.M17, "Flow-Accelerated Corrosion," which 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 which 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; © follow-up inspections to confirm the predictions; and (d) repairing or replacing components, as necessary. The MNGP Flow-Accelerated Corrosion Program includes the response to NRC Generic Letter GL 89-08, Erosion/Corrosion Induced Pipe Wall Thinning.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M17.

During the audit and review, the staff 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 percent of nominal wall thickness for safety-related piping or 60 percent 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 percent of pipe nominal wall as a trigger point for requiring engineering evaluation for non safety-related piping. The applicant determined that, while the 60 percent 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 at MNGP. By letter dated August 11, 2005, the applicant provided its LRA supplement and committed to revise its procedure for the FAC Inspection Program to use the industry accepted 87.5 percent of the nominal pipe wall thickness for non safety-related piping as a trigger point for an engineering evaluation.

On the basis of its review, the staff found that applicant's response adequately addressed the minimum wall thickness evaluation and therefore, found the applicant's response acceptable.

The staff reviewed those portions of the MNGP AMP B2.1.19, "Flow-Accelerated Corrosion Program," which the applicant claims are consistent with GALL AMP XI.M17," "Flow-Accelerated Corrosion," and found that they are consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conforms to the recommended GALL AMP.

Operating Experience. In LRA Section B2.1.19, the applicant explained that the Flow-Accelerated Corrosion Program 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 MNGP has resulted in the identification and replacement of susceptible piping sections with materials more resistant to flow-accelerated corrosion (e.g., extraction steam system piping and piping downstream of the moisture separators). The FAC Program was originally outlined in NUREG-1344 and implemented through GL 89-08. The MNGP program has evolved through industry experience and is now implemented using the guidelines of NSAC-202L-R2 and CHECWORKS as a predictive tool. Monitoring locations and inspection methods have improved over time based on industry and plant experience and through development of new techniques.

On the basis of its review of the above operating experience, and on discussions with the applicant's technical staff, the staff concluded that the applicant’s Flow-Accelerated Corrosion Program will adequately manage the aging effects that have been observed at the applicant’s plant.

USAR Supplement. In a letter dated June 10, 2005, Enclosure 2, Section A2.1.19, the applicant provided the USAR supplement for the Flow-Accelerated Corrosion Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

In a letter dated August 11, 2005, the applicant stated that the NMC fleet procedure for the Flow Accelerated Corrosion Inspection Program will be revised to include the accepted 87.5 percent of nominal pipe wall thickness for non safety-related piping as a trigger point for engineering analysis. This commitment will be documented in the first Annual LRA Supplement required by 10 CFR Part 54, §54.21(b). This issue is identified as a Confirmatory Item 3.0.3.1.2-1.

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

3.0.3.1.3 Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program

Summary of Technical Information in the Application. In LRA Section B2.1.21, the applicant described the Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program, stating that this is a new program that is consistent with GALL AMP XI.E3, “Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.” The intended function of insulated cables and connections is to provide electrical connections to specified sections of an electrical circuit to

deliver voltage, current or signals. Most electrical cables at the MNGP are located in dry environments. However, some cables may be exposed to condensation and wetting in inaccessible locations, such as conduits, cable trenches, cable troughs, duct banks, underground vaults or direct buried installations. 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. This can potentially lead to electrical failure. In this aging management program, periodic actions are 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 is to be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, polarization index, or other testing that is state-of-the-art at the time the test is performed.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP.XI.E3.

During the audit and review, the staff 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 staff reviewed this response and determined that it is acceptable.

The staff 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 Program," which the applicant claims are consistent with GALL AMP XI.E.3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP.

Operating Experience. In LRA Section B2.1.21, the applicant explained that the Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ 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 staff 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 Institute of Nuclear Power Operations (INPO), Licensing Information Service (LIS), NMC Fleet, NRC, and Part 21 issues. The staff reviewed the applicant's response and determined that it is acceptable.

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

USAR Supplement. In LRA Section A2.1.21, the applicant provided the USAR supplement for the Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program.

Subsequently, by letter dated June 10, 2005, 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 staff reviewed this section and determined that the information in the USAR supplement as augmented by the LRA supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as

required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.1.4 One-Time Inspection Program

Summary of Technical Information in the Application. In LRA Section B2.1.23, the applicant described the One-Time Inspection Program, stating that this is a new program that is consistent with GALL AMP XI.M32, “One-Time Inspection.” The applicant stated 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 the scope of license renewal. 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; © 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 is expected to manage the aging effects due to corrosion, cracking, erosion, fouling, fretting, or thermal exposure. The program will also verify the no reduction of neutron absorption capacity of boral in the spent fuel pool.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff’s MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M32.

The staff reviewed those portions of the MNGP AMP B2.1.23, “One-Time Inspection Program," which the applicant claims are consistent with GALL AMP XI.M32, “One-Time Inspection," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant’s AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant’s LRA AMP acceptable because it conformed to the recommended GALL Report AMP.

Operating Experience. In LRA Section B2.1.23, the applicant explained that the One-Time Inspection Program is a new program and does not have any operating experience.

During the audit and review, the staff 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 staff reviewed the applicant's response and determined that it is acceptable.

The staff recognized 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.

<u>USAR Supplement</u>. In LRA Section A2.1.23, the applicant provided the USAR supplement for the One-Time Inspection Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.1.5 Open-Cycle Cooling Water System Program

<u>Summary of Technical Information in the Application</u>. In LRA Section B2.1.24, the applicant described the Open-Cycle Cooling Water (OCCW) System Program, stating that this is an existing program that is consistent with GALL AMP XI.M20, "Open-Cycle Cooling Water System." 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 OCCW 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.

<u>Staff Evaluation</u>. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's evaluation of this AMP are documented

in the MNGP audit and review report. The staff determined that this AMP is consistent with the AMP described in the GALL Report, including the associated operating experience attribute.

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M20.

The staff reviewed those portions of the MNGP AMP B2.1.24, "Open-Cycle Cooling Water System Program," which the applicant claims are consistent with GALL AMP XI.M20, "Open-Cycle Cooling Water System," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP.

Operating Experience. In LRA Section B2.1.24, the applicant stated that the 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.

The staff 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, the staff concluded 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.

USAR Supplement. In LRA Section A2.1.24, the applicant provided the USAR supplement for the Open-Cycle Cooling Water System Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.1.6 Primary Containment In-Service Inspection Program

Summary of Technical Information in the Application. In LRA Section B2.1.26, the applicant described the Primary Containment In-Service Inspection Program, stating that this is an

existing program that is consistent with GALL AMP XI.S1, “ASME Section XI, Subsection IWE.” The MNGP Primary Containment In-Service 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 applicant stated the program conforms to the applicable requirements of 10 CFR 50.55a 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 in-service 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 CFR 50.55a.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff’s MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.S1.

The applicant stated 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 staff 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 staff 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, the applicant stated 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 staff found the applicant’s position acceptable.

The staff reviewed those portions of the MNGP AMP B2.1.26, “Primary Containment In-Service Inspection Program," which the applicant claims are consistent with GALL AMP XI.S1,“ASME Section XI, Subsection IWE," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant’s AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant’s LRA AMP acceptable because it conformed to the recommended GALL Report AMP.

Operating Experience. In LRA Section B2.1.26, the applicant stated that the Primary Containment In-Service 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. The applicant also stated that leakage testing has been effective in early detection of passive isolation barrier (active barriers are outside the scope of the aging management program) deterioration. In-Service 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.

On the basis of its review of the above operating experience and on discussions with the applicant's technical staff, the staff concluded 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.

USAR Supplement. In LRA Section A2.1.26, the applicant provided the USAR supplement for the Primary Containment In-Service Inspection Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.1.7 Reactor Head Closure Studs Program

Summary of Technical Information in the Application. In LRA Section B2.1.28, the applicant described the Reactor Head Closure Studs Program, stating that this is an existing program that is consistent with GALL AMP XI.M3, "Reactor Head Closure Studs." The MNGP Reactor Head Closure Studs Program is part of the MNGP ASME Section XI In-Service Inspection Program. The Reactor Head Closure Studs Program is in accordance with ASME Section XI 1995 Edition through the 1996 Addenda and provides for condition monitoring of the reactor head closure stud bolting. Replacement reactor head studs available for use at Monticello include preventive measures described in RG 1.65, Material and Inspection for Reactor Vessel Closure Studs. The program is updated periodically as required by 10 CFR 50.55a.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M3.

The staff reviewed those portions of the MNGP AMP B2.1.28, "Reactor Head Closure Studs Program," which the applicant claims are consistent with GALL AMP XI.M3, "Reactor Head Closure Studs," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the exceptions as described below.

During the audit and review, the staff 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 staff 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 staff 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, supplemented by a letter dated August 31, 2005, 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 staff evaluation of these exceptions is provided below.

Exception 1

[Parameters Monitored/Inspected] 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.

<u>Exception</u>: 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 staff 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 staff 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 staff 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 staff 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 staff 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, the staff found this exception to be acceptable.

Exception 2

[Corrective Actions] The GALL Report identified the following recommendations for the "corrective action" program element associated with the exception:

> Repair and replacement are in conformance with the requirements of IWB-4000 and IWB-7000, respectively, and the material and inspection guidance of RG 1.65.

<u>Exception</u>: 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 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 staff 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.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.28 for which the applicant claims consistency with GALL AMP XI.M3 are consistent with the GALL Report.

<u>Operating Experience</u>. In LRA Section B2.1.28, the applicant stated that the Reactor Head Closure Studs Program has been effective in managing the aging effects of RPV closure studs. Plant operating experience has been considered in the evaluation of stud performance. The MNGP inspection and testing methodologies have detected no cracking, NDE indications or aging effects for the RPV studs. IGSCC was seen in two RPV head studs at another plant. In response to this incident, MNGP performed field hardness testing, ultrasonic examination of the reactor head studs removed from the reactor cavity during the 1991 outage, evaluated the test results, and evaluated the original Certified Material Test Reports. No evidence of RPV head stud cracking was found.

The staff 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 discussions with the applicant's technical staff, the staff concluded 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.

<u>USAR Supplement</u>. In LRA Section A2.1.28, the applicant provided the USAR supplement for the Reactor Head Closure Studs Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.1.8 Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program

Summary of Technical Information in the Application. In LRA Section B2.1.33, the applicant described the Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program, stating that this is an existing program that is consistent with GALL AMP XI.M13, "Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)." The MNGP Thermal Aging and Neutron Irradiation Embrittlement of CASS Program monitors the aging effect 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 In-Service 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 program is updated periodically as required by 10 CFR 50.55a.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M13.

During the audit and review, the staff 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 staff found this approach is conservative and therefore acceptable.

During the audit and review, the staff 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, the applicant identified the following exception to the GALL Report program element:

Exception

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

> Repair is in conformance with IWA-4000 and IWB-4000, and replacement is in accordance with IWA-7000 and IWB-7000.

<u>Exception</u>: 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 applicant stated 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 staff 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.

The staff reviewed those portions of the MNGP AMP B2.1.33, "Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program," which the applicant claims are consistent with GALL AMP XI.M13, "Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP.

Operating Experience. In LRA Section B2.1.33, the applicant explained that the Thermal Aging & 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.

In addition, the staff 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 staff concluded that MNGP AMP B2.1.33 will adequately manage the aging effects that are identified in MNGP LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.33, the applicant provided the USAR supplement for the Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.1.9 Electrical Equipment Subject to 10 CFR 50.49 Environmental Qualification (EQ) Requirements Program

Summary of Technical Information in the Application. In LRA Section B3.1, the applicant described the Electrical Equipment Subject to 10 CFR 50.49 Environmental Qualification (EQ) Requirements Program, stating that this is an existing program that is consistent with GALL AMP X.E1, "Environmental Qualification (EQ) of Electrical Components." 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.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP X.E1.

The staff reviewed those portions of the MNGP AMP B3.1, "Electrical Equipment Subject to 10 CFR 50.49 Environmental Qualification (EQ) Requirements Program," which the applicant claims are consistent with GALL AMP X.E1, "Environmental Qualification (EQ) of Electrical Components," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP.

Operating Experience. In LRA Section B3.1, the applicant explained that the Electrical Equipment Subject to 10 CFR 50.49 Environmental Qualification (EQ) Requirements Program includes monitoring and assessment of industry information in order to assess its impact on EQ components at 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 applicant cites the following examples to demonstrate 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 2 green findings and 4 corrective actions
- Nuclear Oversight Quality Assurance Assessment, June 2003 - 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 - program health reviews 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. These items 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 staff concluded that the Electrical Equipment Subject to 10 CFR 50.49 EQ Requirements Program will adequately manage the aging effects that have been observed at the applicant's plant.

USAR Supplement. In LRA Section A4.1, the applicant provided the USAR supplement for the Electrical Equipment Subject to 10 CFR 50.49 Environmental Qualification (EQ) Requirements Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Electrical Equipment Subject to 10 CFR 50.49 Environmental Qualification (EQ) Requirements Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. The staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the USAR supplement for this AMP and concluded that it provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

3.0.3.2 AMPs that are Consistent with the GALL Report with Exceptions or Enhancements

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

- 10 CFR 50, Appendix J Program (B2.1.1)
- ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2)
- ASME Section XI, Subsection IWF Program (B2.1.3)
- Bolting Integrity Program (B2.1.4)
- Buried Piping & Tanks Inspection Program (B2.1.5)
- BWR Control Rod Drive Return Line Nozzle Program (B2.1.7)
- BWR Feedwater Nozzle Program (B2.1.8)
- BWR Penetrations Program (B2.1.9)
- BWR Stress Corrosion Cracking Program (B2.1.10)
- BWR Vessel ID Attachment Welds Program (B2.1.11)
- BWR Vessel Internals Program (B2.1.12)
- Closed-Cycle Cooling Water System Program (B2.1.13)
- Compressed Air Monitoring Program (B2.1.14)
- Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program (B2.1.16)
- Fire Protection Program (B2.1.17)

- Fire Water System Program (B2.1.18)
- Fuel Oil Chemistry Program (B2.1.20)
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program (B2.1.22)
- Plant Chemistry Program (B2.1.25)
- Protective Coating Monitoring & Maintenance Program (B2.1.27)
- Reactor Vessel Surveillance Program (B2.1.29)
- Selective Leaching of Materials Program (B2.1.30)
- Structures Monitoring Program (B2.1.31)
- Metal Fatigue of the Reactor Coolant Pressure Boundary Program (B3.2)

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

3.0.3.2.1 10 CFR 50, Appendix J Program

Summary of Technical Information in the Application. In LRA Section B2.1.1, the applicant described the 10 CFR 50, Appendix J Program, stating that this is an existing program that is consistent, with exceptions, with GALL AMP XI.S4, "10 CFR 50, Appendix J." The MNGP 10 CFR 50, Appendix J 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 as required to keep overall and local leakage under Technical Specification and plant administrative limits. Tests are performed at intervals determined by the risk and performance factors applicable to each tested item in accordance with governing regulations and standards. Visual examinations are performed prior to each Type A test. These examinations are also performed at least once during each containment in-service 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.

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

documented in the MNGP audit and review report. The staff reviewed the exceptions and the associated justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.S4.

The staff reviewed those portions of the MNGP AMP B2.1.1, "10 CFR 50, Appendix J Program," which the applicant claims are consistent with GALL AMP XI.S4," 10 CFR 50, Appendix J" and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL AMP with the exceptions as described below.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.S4 in the GALL Report.

Exception 1

[Scope of Program] The GALL Report identifies the following recommendation for the scope of 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.

<u>Exception</u>: Main steam isolation valves (MSIVs) are tested at 25 psig instead of at an accident pressure of 42 psig.

In the LRA, the applicant indicated 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 staff 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 staff concluded that this exception is acceptable.

Exception 2

[Monitoring and Trending] The GALL Report identifies the following recommendation for the monitoring and trending 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.

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."

In the LRA, the applicant stated 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 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 staff found 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 staff found this exception to be acceptable.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.1 for which the applicant claims consistency with GALL AMP XI.S4 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.1, the applicant stated that the 10 CFR 50, Appendix J Program Tests conducted under the program have been effective principally in detecting developing leakage through containment isolation valves, which, as active components, are outside the scope of license renewal. Testing has also detected developing leakage in both an electrical penetration conductor seal and a hot piping penetration expansion bellows. Both of these conditions were corrected while the leakage was still small. MNGP has committed to the risk and performance based program defined by 10 CFR 50, Appendix J, Option B. This approach uses plant and industry-wide operating experience as the bases for defining the performance and risk factors, which, in turn, are used to determine testing intervals. Using this approach enhances the effectiveness of the program as an aging management tool by concentrating testing and maintenance resources on components that have higher risk and/or a history of high leakage.

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

On the basis of its review of the above 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.

USAR Supplement. In LRA Section A2.1.1, the applicant provided the USAR supplement for the 10 CFR 50, Appendix J Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.2.2 ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program

Summary of Technical Information in the Application. In LRA Section B2.1.2, the applicant described the ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program, stating that this is an existing program that is consistent, with exceptions, with GALL AMP XI.M1, "ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD." The MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program is part of the MNGP ASME Section XI In-Service Inspection Program. This program is in accordance with ASME Section XI 1995 Edition through the 1996 Addenda and is subject to the limitations and modifications of 10 CFR 50.55a. The program provides for condition monitoring

of Class 1, 2, and 3 pressure-retaining components and their integral attachments. Class 1 and 2 piping is being inspected in accordance with the Risk Informed In-Service Inspection (RI-ISI) Program as described in the Electric Power Research Institute (EPRI) Topical Report TR-112657, Revision B-A, Revised Risk Informed In-Service Inspection Evaluation Procedure. 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 In-Service Inspection Program. The program is updated periodically as required by 10 CFR 50.55a. The Plant Chemistry Program augments this program where applicable.

<u>Staff Evaluation</u>. During its audit and review, the staff confirmed the applicant’s claim of consistency with the GALL Report. Details of the staff’s audit evaluation of this AMP are documented in the MNGP audit and review report. The staff reviewed the exceptions and the associated justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff’s MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M1.

The staff reviewed those portions of the MNGP AMP B2.1.1, “ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program," which the applicant claims are consistent with GALL AMP XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD” and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant’s AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant’s LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the exceptions as described below.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M1 in the GALL Report.

Exceptions 1 and 2

[Scope of Program] The GALL Report identifies the following recommendation for the scope of program element associated with the exception 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.

<u>Exceptions</u>: 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 staff determined 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 staff 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 staff found these exceptions to be acceptable.

During the audit and review, the staff 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. 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:

Exception 3

[Detection of Aging Effects] The GALL Report identifies the following recommendation for the detection of aging effects element associated with the exception taken:

> Category B-G-1 specifies volumetric examination of studs in place, from the top of the nut to the bottom of the flange hole; surface and volumetric examination of studs when removed; volumetric examination of flange threads; and visual VT-1 examination of the surfaces of nuts, washers, and bushings.

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 stated 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 stated 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 stated 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 staff concluded that this is an acceptable exception to the GALL Report.

Exception 4

[Monitoring and Trending] The GALL Report identifies the following recommendation for the monitoring and trending 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.

<u>Exception</u>: 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.

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 stated 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 stated 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 staff concluded that this is an acceptable exception to the GALL Report.

Exception 5

[Detection of Aging Effects] The GALL Report identifies the following recommendation for the detection of aging effects 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.

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-2500-7(b) with regard to the examination volume for Category B-D components.

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 staff reviewed the applicant's description and technical justification for this exception, as summarized in the preceding paragraph. The staff also reviewed applicant's letter to the NRC dated February 27, 2004, "Request for Authorization to Utilize Code Case N-613-1" 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 staff concluded that this exception is acceptable.

Exception 6

[Corrective Action] The GALL Report identifies the following recommendation for the corrective action 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.

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 applicant stated 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 staff concluded 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.

Exception 7

[Detection of Aging Effects] The GALL Report identifies the following recommendation for the detection of aging effects 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 IWA-2240 are also specified in these tables.

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 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)."

In its letter dated August 11, 2005, and supplemented by a letter dated August 31, 2005, 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 staff reviewed the applicant's technical justification for this exception. In addition, the staff reviewed the applicant's detailed RI-ISI program description provided in the letter of December 18, 2001, and the NRC's authorization for MNGP to implement its RI-ISI program in the letter dated July 24, 2002. Based on review of these documents, the staff determined 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 staff concluded 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 staff concluded 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."

Exception 8

[Detection of Aging Effects] The GALL Report identifies the following recommendation for the detection of aging effects 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 percent of the length of the attachment weld at each attachment subject to examination.

<u>Exception</u>: 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.

In its letter dated August 31, 2005, the applicant provided 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 stated 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 stated 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 staff reviewed the applicant's justification for this exception. In addition, the staff 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)," 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, RAI B2.1.2-1 was issued on August 18, 2005, to obtain additional technical basis to accept this exception. 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, 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 stated 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 staff concluded 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.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.2 for which the applicant claims consistency with GALL AMP XI.M1 are consistent with the GALL Report.

<u>Operating Experience</u>. In LRA Section B2.1.2, the applicant stated that a review of operating experience for the ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program identified no adverse trends or issues with program performance. Problems were identified and corrected prior to causing any significant impact to safe operation or loss of intended functions. Corrective actions were taken to prevent recurrence. The MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program monitors the condition of the pressure retaining components within the License Renewal (LR) boundary. Guidance is contained in MNGP procedures for indications of degradation requiring evaluation, repair, or replacement. Periodic self-assessments and reviews of industry and plant experience are performed to identify any areas needing improvement. Some examples include:

- MNGP modified its MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program at the end of the third interval due to an improved strategy for NDE as described in the EPRI TR-112657, Revised Risk-Informed In-Service Inspection Evaluation Procedure, and in compliance with the requirements of Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," and 1.178, "An Approach for Plant-Specific Risk-Informed Decision-making for In-Service Inspection of Piping."

- Inspections in 1998 and 2001 of Steam Dryer Jacking Screws revealed a crack-like indication in the screw tack weld at 325 degrees. Following the inspection in 1998, an evaluation was done that indicated the crack was acceptable. Re-inspections of the Jacking Screws in 2001 showed no crack growth in the 325-degree screw and no indications of cracking in the other screws.

- Cracking was detected in 34 tack welds on jet pump beam adjusting screws in 1994 during the End of Cycle-16 IVVI visual inspection. Cracking was ascribed to high cycle fatigue. Tack welds were restored so that each adjusting screw had a minimum of one uncracked tack weld. Tack welds are and continue to be visually inspected.

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

On the basis of its 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 staff concluded 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 the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.2, the applicant provided the USAR supplement for the ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.2.3 ASME Section XI, Subsection IWF Program

Summary of Technical Information in the Application. In LRA Section B2.1.3, the applicant described the ASME Section XI, Subsection IWF Program, stating that this is an existing program that is consistent, with enhancement, with GALL AMP XI.S3, "ASME Section XI, Subsection IWF." The MNGP ASME Section XI, Subsection IWF Program is part of the MNGP ASME Section XI In-Service 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. The program is updated periodically as required by 10 CFR 50.55a.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.S3.

The staff reviewed those portions of the MNGP AMP B2.1.3, "ASME Section XI, Subsection IWF Program," which the applicant claims are consistent with GALL AMP XI.S3, "ASME Section XI, Subsection IWF," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the exception and

enhancement as described below.

In the LRA, the applicant stated 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 and review, the staff 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 11, 2005, and supplemented by a letter dated August 31, 2005, the applicant identified, for Code Case N–491-2, the following exception to the GALL Report program element:

Exception

[Corrective Actions] 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.

<u>Exception</u>: 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 applicant stated 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 stated in its letter dated August 11, 2005, 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, the staff found this exception to be acceptable.

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

Enhancement [Scope of Statement] 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.

<u>Enhancement</u>: 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, "Supports for ASME Class MC Components."

During the audit and review, the staff 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 stated 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 staff reviewed the applicant's response together with the applicant's program basis document for the IWF Program. The staff concluded 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 staff found the applicant's response acceptable.

The staff asked whether the applicant's program, when enhanced as described in the 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 staff reviewed the applicant's response together with the applicant's proposed enhancement to the existing program as described in the LRA and evaluated in the applicant's program basis documents. Based on this review, the staff concluded that appropriate components are included in the applicant's program as required by ASME Section XI, Table IWF-2500-1. On this basis, the staff determined the applicant's response to be acceptable.

Based on the applicant's responses to the staff's questions and review of associated documents provided by the applicant, the staff 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 stated, in the 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, the staff found this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.3 for which the applicant claims consistency with GALL AMP XI.S3 are consistent with the GALL Report.

<u>Operating Experience</u>. In LRA Section B2.1.3, the applicant stated that industry operating experience and the need for additional augmented requirements for Class 1, 2, 3, and MC component supports is addressed and prescribed by the MNGP ASME Section XI, Subsection IWF Program, as applicable. In addition, MNGP has been performing a general visual

examination on accessible Class MC component supports in accordance with the ASME Section XI, Subsection IWE Program and has not identified any aging effects of concern.

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

On the basis of its 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 staff concluded 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.

USAR Supplement. In a letter dated June 10, 2005, Enclosure 2, Appendix A, Section A2.1.3, the applicant provided the USAR supplement for the ASME Section XI, Subsection IWF Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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.

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

3.0.3.2.4 Bolting Integrity Program

Summary of Technical Information in the Application. In LRA Section B2.1.4, the applicant described the Bolting Integrity program, stating that this is an existing program that is consistent, with enhancements, with GALL AMP XI.M18, "Bolting Integrity." The Bolting Integrity program manages the aging effects associated with bolting in the scope of license renewal through periodic inspection, material selection, thread lubricant control, assembly and torque requirements, and repair and replacement requirements. These activities are based on the applicable requirements 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 NP-5769, "Degradation and Failure of Bolting in Nuclear Power Plants," EPRI TR-104213, "Bolted Joint Maintenance & Application Guide," and EPRI NP-5067, Volumes 1 and 2, "Good Bolting Practices." The

program credits other MNGP Aging Management Programs for the inspection of installed bolts. These other programs are: (1) 10 CFR 50, Appendix J; (2) ASME Section XI In-Service Inspection, Subsections IWB, IWC and IWD; (3) Primary Containment In-Service Inspection; (4) Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems; (5) ASME Section XI, Subsection IWF; (6) Buried Piping and Tanks Inspection; (7) Bus Duct Inspection; (8) BWR Vessel Internals; (9) Reactor Head Closure Studs Monitoring; (10) System Condition Monitoring; and (11) Structures Monitoring.

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

<INSERT Supplemental Information Provided by Tech Staff (EMCB-B/Georgiev; EMEB-B/Strnisha)>

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.4 for which the applicant claims consistency with GALL AMP XI.M18 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.4, the applicant stated that both the industry and NRC have revealed a number of instances of bolting concerns relating to material control, certification to bolting practices, use of lubrication, and the impact of aging mechanisms. The MNGP Bolting Integrity Program incorporates both plant and industry experience on bolting issues into the program. For example, NRC Information Notices, Bulletins, Circulars, and Generic Letters listed in Section 3 of NUREG-1339 were previously evaluated and addressed at MNGP. Some of these resulted in confirmatory analysis or inspections and others in modifications or the addition of special items to consider in the procurement and design processes. All reactor vessel shroud head bolts were replaced with a new vendor-recommended design, for example, when cracking issues were identified with the prior design. A review of plant operating experience identified issues with missing or loose bolts, inadequate thread engagement, and improper bolt applications. In all cases, the identified concern was corrected; no significant safety event resulted; and additional actions, such as procedural enhancements, were implemented as needed to minimize the potential for recurrence.

<INSERT Supplemental Information Provided by Tech Staff (EMCB-B/Georgiev; EMEB-B/Strnisha)>

USAR Supplement. In LRA Section A2.1.4, the applicant provided the USAR supplement for the Bolting Integrity Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Bolting Integrity Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. Also, the staff reviewed the enhancements and confirmed that the implementation of the enhancements prior to the period

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

3.0.3.2.5 Buried Piping & Tanks Inspection Program

Summary of Technical Information in the Application. In LRA Section B2.1.5, the applicant described the Buried Piping & Tanks Inspection Program, stating that this is an existing program that is consistent, with enhancements, with GALL AMP XI.M34, "Buried Piping and Tanks Inspection." The Buried Piping & Tanks Inspection Program consists of preventive and condition monitoring measures to manage the aging effects for buried piping, conduit and tanks within the scope of license renewal. Buried components within the scope of 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 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.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M34.

The staff reviewed those portions of the MNGP AMP B2.1.5, "Buried Piping & Tanks Inspection Program," which the applicant claims are consistent with GALL AMP XI.M34, "Buried Piping & Tanks Inspection," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the enhancements as described below.

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

Enhancement 1

[Scope of Program] 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.

<u>Enhancement</u>: The Buried Tank and Inspection Program will be updated to implement procedures to include inspections of buried components when they are uncovered.

The applicant stated, in the 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 staff reviewed the applicant’s response and plant procedures, and found this enhancement to be acceptable as such changes to the applicant’s program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 2

[Parameters Monitored or Inspected] 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.

<u>Enhancement</u>: 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.

During the audit and review, the staff asked the applicant what types of inspections will be performed for this program before the period of extended operation. In response, the applicant stated 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. Additionally, the applicant stated that a visual and UT inspection of the buried pipe near the off-gas stack was performed in 1999 and no degradation due to aging

effects were noted. The applicant noted in it response to the staff'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 staff reviewed the applicant's response and evaluated plant procedures. The staff noted that the applicant's buried Diesel Fuel Oil Storage Tank inspection is an internal inspection. The applicant was requested to provide further clarification how it intends to inspect the buried Diesel Fuel Oil Storage Tank externally, per the GALL Report recommendation (RAI 2.1.5-1).

In response dated XXXX, the applicant stated...

Enhancement 3

[Detection of Aging Effects] 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.

<u>Enhancement</u>: 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.

In the LRA, the applicant stated 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 staff asked the applicant if inspection activities will be performed before the period of extended operation. The applicant stated in its response to the staff'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 staff reviewed the applicant's response and plant procedures, and found that with the exception of the Diesel Fuel Oil Storage Tank issue raised in RAI 2.1.5-1, the enhancement described here is 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.

Enhancement 4

[Monitoring and Trending] 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.

Enhancement: The underground piping inspections are to include a review of previous buried piping issues to determine possible 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 staff'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 staff reviewed the applicant's response and found 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 its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.5 for which the applicant claims consistency with GALL AMP XI.M34 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.5, the applicant stated that the Buried Piping & Tanks Inspection Program relies on preventive measures, periodic inspections and functional testing to manage the aging effects of buried components. MNGP operating experience has shown no buried component failures for in-scope systems (Emergency Service Water, Diesel Generator, Hangars and Supports, Secondary Containment System, Fire System). 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 within the scope of license renewal. The locations of the failures are not near any buried components within the scope of license renewal. 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 also 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 groundwater monitoring near the diesel fuel oil storage tank have shown no functional failures of the storage tank or the diesel fuel oil lines.

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

On the basis of its review, MNGP operating experience documentation, and discussions with the applicant's technical staff, the staff concluded that the applicant's AMP B2.1.5 will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

USAR Supplement. In a letter dated June 10, 2005, Enclosure 2, Section A2.1.5, the applicant provided the USAR supplement for the Buried Piping & Tanks Inspection Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

In addition, the applicant stated 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.

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

3.0.3.2.6 BWR Control Rod Drive Return Line Nozzle Program

Summary of Technical Information in the Application. In LRA Section B2.1.7, the applicant described the BWR Control Rod Drive Return Line Nozzle Program, stating that this is an

existing program that is consistent, with exceptions, with GALL AMP XI.M6, “BWR Control Rod Drive Return Line Nozzle.” The MNGP BWR Control Rod Drive Return Line Nozzle Program is part of the MNGP ASME Section XI In-Service 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. 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 of non-IGSCC susceptible stainless steel. As a result of capping the CRDRL nozzle, the NUREG-0619 augmented examinations are no longer required. Not performing the NUREG-0619 augmented examinations is considered a NUREG-1801 XI.M6 program exception. The program is updated periodically as required by 10 CFR 50.55a.

<u>Staff Evaluation</u>. During its audit and review, the staff confirmed the applicant’s claim of consistency with the GALL Report. Details of the staff’s audit evaluation of this AMP are documented in the MNGP audit and review report. The staff reviewed the exceptions and the associated justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff’s MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M6.

The staff reviewed those portions of the MNGP AMP B2.1.7, “BWR Control Rod Drive Return Line Nozzle Program," which the applicant claims are consistent with GALL AMP XI.M6, “BWR Control Rod Drive Return Line Nozzle," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant’s AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant’s LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the exceptions as described below.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M6 in the GALL Report.

Exception 1

[Parameters Monitored/Inspected, Detection of Aging Effects, and Monitoring and Trending] 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.

Exception: The NUREG-0619 augmented inspections are not performed. 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 stated 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, the staff found this exception to be acceptable.

During the audit and review, the staff 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, the applicant identified the following additional exception to the GALL Report program element:

Exception 2

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

> Repair is in conformance with IWB-4000 and replacement in accordance with IWB-7000.

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 staff concluded 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. The staff's evaluation is documented in Subsection 3.0.3.2.2, Exception 6.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.7 for which the applicant claims consistency with GALL AMP XI.M6 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.7, the applicant stated that the 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. For example, 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. As a result of capping the CRDRL nozzle as discussed above, the NUREG-0619 augmented examinations are no longer required.

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

On the basis of its review of the above operating experience and discussions with the applicant's technical staff, the staff concluded that the applicant's AMP B2.1.7 will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.7, the applicant provided the USAR supplement for the BWR Control Rod Drive Return Line Nozzle Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.2.7 BWR Feedwater Nozzle Program

Summary of Technical Information in the Application. In LRA Section B2.1.8, the applicant described the BWR Feedwater Nozzle Program, stating that this is an existing program that is consistent, with enhancement, with GALL AMP XI.M5, "BWR Feedwater Nozzle." The MNGP BWR Feedwater Nozzle Program is part of the MNGP ASME Section XI In-Service 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.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M5.

The staff reviewed those portions of the MNGP AMP B2.1.8, "BWR Feedwater Nozzle Program," which the applicant claims are consistent with GALL AMP XI.M5, "BWR Feedwater Nozzle," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the exception and enhancement as described below.

During the audit and review, the staff 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, the applicant identified the following additional exception to the GALL Report program element:

Exception

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

> Repair is in conformance with IWB-4000 and replacement in accordance with IWB-7000.

<u>Exception</u>: 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 staff concluded 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. The staff's evaluation is documented in Subsection 3.0.3.2.2, Exception 6.

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

Enhancement

[Parameters Monitored/Inspected, Detection of Aging Effects, and Monitoring and Trending] 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.

<u>Enhancement</u>: 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.”

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, 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 staff 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 staff 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.

On the basis of its review of the above enhancement and discussions with the applicant's technical staff, the staff found this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.8 for which the applicant claims consistency with GALL AMP XI.M5 are consistent with the GALL Report.

<u>Operating Experience</u>. In LRA Section B2.1.8, the applicant stated that 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 staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

On the basis of its review of the above operating experience and discussions with the applicant's technical staff, the staff concluded that the applicant's AMP B2.1.8 will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

USAR Supplement. In a letter dated June 10, 2005, Enclosure 2, Section A2.1.8, the applicant provided the USAR supplement for the BWR Feedwater Nozzle Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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.

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

3.0.3.2.8 BWR Penetrations Program

Summary of Technical Information in the Application. In LRA Section B2.1.9, the applicant described the BWR Penetrations Program, stating that this is an existing program that is consistent, with exceptions, with GALL AMP XI.M8, "BWR Penetrations." The MNGP BWR Penetrations Program is part of the MNGP ASME Section XI In-Service Inspection Program. The BWR Penetrations Program is in accordance with ASME Section XI 1995 Edition through the 1996 Addenda and provides for condition monitoring of the BWR penetrations. The BWR water chemistry is controlled per the EPRI guidelines of BWRVIP-130 (TR-1008192), "BWR Water Chemistry Guidelines - 2004 Revision." BWRVIP-130 supersedes previous revisions of the guidelines, including BWRVIP-29 (TR-103515), "BWR Water Chemistry Guidelines - 1993 Revision." MNGP's 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 the Standby Liquid Control System. The program is updated periodically as required by 10 CFR 50.55a and the BWRVIP.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff’s MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M8.

The staff reviewed those portions of the MNGP AMP B2.1.9, “BWR Penetrations Program," which the applicant claims are consistent with GALL AMP XI.M8, “BWR Penetrations," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant’s AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant’s LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the exceptions as described below. .

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M8 in the GALL Report.

Exception 1

[Program Description and Preventive Actions] 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).

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 evaluation of this exception is performed as part of the plant chemistry program. The plant chemistry program description, evaluation, and technical basis of monitoring reactor water chemistry is documented in Subsection 3.0.3.2.19.

The applicant stated, in the 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 staff 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, the applicant identified the following additional exception to the GALL Report program elements:

Exception 2

[Detection of Aging Effects] 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.

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

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, the applicant stated 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 staff reviewed the applicant's description and technical justification for this exception as summarized in the preceding paragraph. The staff 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 staff concluded that this exception is acceptable.

During the audit and review, the staff 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 staff 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.

Exception 3

[Detection of Aging Effects] The GALL Report identifies the following recommendation for the "detection of aging effects" program element associated with the exception:

> 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.

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).

In its letter dated August 31, 2005, 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 staff's evaluation is documented in Subsection 3.0.3.3.2, Exception 7. The same discussion is applicable for evaluation of this exception with regard to GALL AMP XI.M8. Based on the discussion documented in Subsection 3.0.3.3.2 of this SER, the staff concluded that the applicant's implementation of risk-informed ISI is an acceptable exception 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.

On the basis of the review of the above exceptions and the review of operating experience for the MNGP AMP B2.1.9 Program, the staff found these exceptions to be acceptable.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.9 for which the applicant claims consistency with GALL AMP XI.M8 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.9, the applicant stated that materials within the scope of the BWR Penetrations Program are periodically examined and evaluated for corrective action as needed. Vendor guidance (e.g., BWRVIP-49 and 27) has been incorporated into the program. Corrective actions to replace materials susceptible to cracking have been implemented, as the following examples indicate: (1) the standby liquid control nozzle safe end was replaced in 1984 using different materials to resist IGSCC; (2) in 1984 the jet pump instrumentation safe end and penetration seal were replaced with a jet pump instrumentation nozzle penetration seal using 316L stainless steel materials to resist IGSCC; and (3) a corrosion resistant clad (CRC) overlay was applied to the inside diameter of the Reactor vessel head vent nozzle (N7) and the reactor vessel head cooling spray nozzles N6A & B (penetrations). The CRC overlay isolated the IGSCC susceptible weld butter from the reactor coolant.

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

On the basis of its 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 staff concluded that the applicant's BWR Penetrations Program will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.9, the applicant provided the USAR supplement for the BWR Penetrations Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

The staff noted that this USAR supplement includes parenthetic mention of "approved ISI relief requests." In its letter dated August 31, 2005, the applicant stated that reference to ISI relief requests will be deleted from the USAR Supplemental description of the BWR Penetrations Program.

The staff 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).

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

3.0.3.2.9 BWR Stress Corrosion Cracking Program

Summary of Technical Information in the Application. In LRA Section B2.1.10, the applicant described the BWR Stress Corrosion Cracking Program, stating that this is an existing program that is consistent, with exception, with GALL AMP XI.M7, "BWR Stress Corrosion Cracking." ASME Section XI is being implemented with ultrasonic (UT) volumetric, surface, and visual inspections and the Risk-Informed ISI Program. 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. All IGSCC susceptible materials have been replaced or protected with a cladding of resistant weld material. Therefore, all piping welds are now classified as

IGSCC Category A in accordance with NUREG-0313 and GL 88-01. 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. In addition, 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.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M7.

The applicant stated 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, the applicant stated 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 staff 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 staff concluded 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 staff also found 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 staff reviewed those portions of the MNGP AMP B2.1.10, "BWR Stress Corrosion Cracking Program," which the applicant claims are consistent with GALL AMP XI.M7, "BWR Stress Corrosion Cracking," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program

will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the exceptions as described below.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M7 in the GALL Report.

Exception 1

[Preventive Actions] 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 Reasearch Institute [EPRI] TR-103515).

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.

<u>Exception</u>: The evaluation of this exception is performed as part of the plant chemistry program. The plant chemistry program description, evaluation, and technical basis of monitoring reactor water chemistry is documented in Subsection 3.0.3.2.19 of this SER.

During the audit and review, the staff 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, the applicant identified the following additional exception to the GALL Report program elements:

Exception 2

[Corrective Actions] 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.

<u>Exception</u>: 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 staff concluded 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. The staff's evaluation is documented in Subsection 3.0.3.2.2, Exception 6.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.10 for which the applicant claims consistency with GALL AMP XI.M7 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.10, the applicant stated that a review of plant operating experience for the BWR Stress Corrosion Cracking Program identified no adverse trends or issues with program performance. Problems were identified and corrected prior to causing any significant impact to safe operation and corrective actions were taken to prevent recurrence. The BWR Stress Corrosion Cracking Program detects flaw indications in susceptible components and contains guidance for evaluation or repair of flaws. Periodic self-assessments of the program and reviews of industry and plant experience are performed to identify any needed improvements. Examples of corrective actions implemented as a result of program activities include:

- A corrosion resistant cladding overlay was applied to the inside diameter of the head vent nozzle and head cooling spray and instrumentation nozzles. The weld overlay of 308L isolated the IGSCC susceptible existing weld butter located in the weld residual stress area from the reactor coolant (1984).

- The recirculation inlet safe ends and thermal sleeve assembly and the recirculation outlet safe ends were replaced using nuclear grade stainless steel materials to resist IGSCC (1984).

- New core spray nozzle safe ends featuring a tuning fork design with a thermal sleeve were installed. This modification was performed to minimize IGSCC in the core spray system (1986).

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

On the basis of its 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 staff concluded that the applicant's BWR Stress Corrosion Cracking Program will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.10, the applicant provided the USAR supplement for the BWR Stress Corrosion Cracking Program. The staff reviewed this section and determined that the information in the USAR Supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

The staff 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 stated that reference to the risk-informed ISI program will be deleted from the USAR supplement description of the BWR Stress Corrosion Cracking Program.

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

3.0.3.2.10 BWR Vessel ID Attachment Welds Program

Summary of Technical Information in the Application. In LRA Section B2.1.11, the applicant described the BWR Vessel ID Attachment Welds Program, stating that this is an existing program that is consistent, with exception, with GALL AMP XI.M4, “BWR Vessel ID Attachment Welds.” The MNGP BWR Vessel ID Attachment Welds Program is part of the MNGP ASME Section XI In-Service Inspection Aging Management Program. 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 and Inspection and Flaw Guidelines” (EPRI TR-108724). The BWR water chemistry is controlled per the EPRI guidelines of BWRVIP-130 (TR-1008192), “BWR Water Chemistry Guidelines - 2004 Revision.” The program is updated periodically as required by 10 CFR 50.55a. In addition, the program is supplemented by implementing the guidelines of the Boiling Water Reactor Vessel and Internals Project.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff’s MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M4.

The staff reviewed those portions of the MNGP AMP B2.1.11, “BWR Vessel ID Attachment Welds Program," which the applicant claims are consistent with GALL AMP XI.M4, “BWR Vessel ID Attachment Welds," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant’s AMP provided reasonable assurance that

the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the exceptions as described below.

In the LRA, the applicant stated the following exception to the program elements listed for AMP XI.M4 in the GALL Report.

Exception 1

[Preventive Actions] 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."

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 staff found this exception to be acceptable. The staff's evaluation is documented in Subsection 3.0.3.2.19, Exception 1.

During the audit and review, the staff 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, the applicant identified the following additional exception to the GALL Report program elements:

Exception 2

[Corrective Actions] 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 found 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.

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 staff concluded 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. The staff's evaluation is documented in Subsection 3.0.3.2.2, Exception 6.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.11 for which the applicant claims consistency with GALL AMP XI.M4 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.11, the applicant stated that engineering evaluations were performed based on plant and industry experience and component and programmatic corrective actions implemented as required. For example, a vendor notification discussed the susceptibility of Alloy 182 welds to IG/DSCC in shroud support structures such as those used in the Monticello vessel and shroud. BWRVIP-38 provides guidance on the inspection of the shroud support structure. The 2000 outage included inspection of the recommended 10-percent portions of the H8 and H9 welds using EVT-1 techniques around the access holes at the 0 and 180º locations. No indications were found. In addition, 14 shroud support legs were inspected using a VT-3 technique due to flaw indications found on the initially examined support leg. Monticello continues to inspect the H8 and H9 welds in accordance with BWRVIP-38. No operability impacts have been found.

The staff 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 staff concluded that the applicant's BWR Vessel ID Attachment Welds Program will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.11, the applicant provided the USAR supplement for the BWR Vessel ID Attachment Welds Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

The staff noted that this USAR supplement includes mention of "approved ISI relief requests." In its letter dated August 31, 2005, the applicant stated that reference to ISI relief requests will be deleted from the USAR supplement description of the BWR Vessel ID Attachment Welds Program.

Conclusion. On the basis of its review and audit of the applicant's BWR Vessel ID Attachment Welds Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. In addition, the staff reviewed the exceptions, and the associated justifications, and determined that the AMP, with the exceptions, is adequate to manage the aging effects for which it is credited. The staff concluded that the applicant demonstrated that the effects of aging will be adequately

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

3.0.3.2.11 BWR Vessel Internals Program

Summary of Technical Information in the Application. In LRA Section B2.1.12, the applicant described the BWR Vessel Internals Program, stating that this is an existing program that is consistent, with exception and enhancement, with GALL AMP XI.M9, "BWR Vessel Internals." The MNGP BWR Vessel Internals Program is part of the MNGP ASME Section XI In-Service Inspection Program. The BWR Vessel Internals Program is in accordance with ASME Section XI 1995 Edition through the 1996 Addenda. The program provides for condition monitoring of the BWR vessel internals for crack initiation and growth. 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. 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 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). The program is updated periodically as required by 10 CFR 50.55a and the BWRVIP Program.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M9.

The staff reviewed those portions of the MNGP AMP B2.1.12, "BWR Vessel Internals Program," which the applicant claims are consistent with GALL AMP XI.M9, "BWR Vessel Internals," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the exception and enhancement described below.

During the audit and review, the staff noted that, in the MNGP LRA, the applicant's program description stated 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 staff asked the applicant to clarify the phrase "and approved ISI relief requests" in the LRA program description. In its letter dated August 11, 2005, the applicant stated 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 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 31, 2005, 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 staff found that no approved MNGP ISI relief request affects any of MNGP's BWR Vessel Internals Program elements. On this basis, the staff also found 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.

In the LRA, the applicant stated the following exception to the program elements listed for AMP XI.M9 in the GALL Report.

Exception

[Preventive Actions] 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."

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 staff found this exception to be acceptable. The staff's evaluation is documented in Subsection 3.0.3.2.19, Exception 1.

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

Enhancement

[Scope of 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.

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 applicant stated 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 staff found 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.

The staff 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 staff review of the applicant's implementation documents that indicate a very high

degree of conformance to BWRVIP guidelines, the staff considered this response to be acceptable.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.12 for which the applicant claims consistency with GALL AMP XI.M9 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.12, the applicant stated that the BWR Vessel Internals Program is based on inspection requirements contained in plant procedures, which incorporate the requirements of the ASME Code. Further, the ASME Code inspections are enhanced with inspection requirements consistent with the BWRVIP. The inspection and testing methodologies have been effective in detecting aging effects due to crack initiation and growth. Engineering evaluations were performed based on plant and industry experience and component and programmatic corrective actions were implemented as required. For example:

- 2003: UT inspection of the core spray line found cracking in the core spray piping slip joint welds. The previous evaluation was determined to bound the current flaw size, and no further action was necessary.

- 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.

- 1994: Visual inspection of the jet pumps during the 1994 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 staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

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

USAR Supplement. In a letter dated June 10, 2005, Enclosure 2, Section A2.1.12, the applicant provided the USAR supplement for the BWR Vessel Internals Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

The staff noted that this USAR supplement also includes mention of "approved ISI Relief Requests." In its letter dated August 31, 2005, the applicant stated 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 5.0 x 10^{20} n/cm2). Ten percent of the total population will be inspected within 12 years with a minimum of 5 percent inspected within the first 6 years.

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

3.0.3.2.12 Closed-Cycle Cooling Water System Program

Summary of Technical Information in the Application. In LRA Section B2.1.13, the applicant described the Closed-Cycle Cooling Water System Program, stating that this is an existing program that is consistent, with exceptions and enhancement, with GALL AMP XI.M21, "Closed-Cycle Cooling Water System." The MNGP 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. EPRI TR-1007820 is the current revision (Revision 1) of EPRI-107396. 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.

MNGP has four systems within the scope of license renewal 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 in which 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. 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. 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.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M21.

The staff reviewed those portions of the MNGP AMP B2.1.13, "Closed-Cycle Cooling Water System Program," which the applicant claims are consistent with GALL AMP XI.M21, "Closed-Cycle Cooling Water System," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the exceptions and enhancement as described below.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M21 in the GALL Report.

Exception 1

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

> 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 noted 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.

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 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 staff reviewed the standards of EPRI TR-107396 and compared them to EPRI TR-1008720. The staff 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 staff 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 staff determined that there were no technical concerns associated with the use of EPRI TR-1008720.

Exception 2

[Preventive Actions] 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.

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 applicant stated in the 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 stated 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 staff noted that specific parameters monitored or excluded are noted in the 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.

The staff 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, the staff found this exception to be acceptable.

Exception 3

[Parameters Monitored/Inspected] 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.

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 staff 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 staff 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 staff found that the additional information that the applicant has gathered is an adequate substitute for that information, recommended by the GALL Report. The staff reviewed the applicant's additional information and found it acceptable.

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 staff 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 staff 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 staff 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. The staff found that the additional information that the applicant has gathered is an adequate substitute for that information, recommended by the GALL Report. The staff reviewed the applicant's additional information and found it acceptable.

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). The staff found that the additional information that the applicant has gathered is an adequate substitute for that information, recommended by the GALL Report. The staff reviewed the applicant's additional information and found it acceptable.

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. The staff found that the additional information that the applicant has gathered is an adequate substitute for that information, recommended by the GALL Report. The staff reviewed the applicant's additional information and found it acceptable.

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 staff found that the additional information that the applicant has gathered is an adequate substitute for that information, recommended by the GALL Report. The staff reviewed the applicant's additional information and found it acceptable.

On the basis of the above review, and of a review of MNGP operating experience for the AMP B2.1.13 program, the staff found this exception to be acceptable.

Exception 4

[Acceptance Criteria] 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.

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 staff 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 staff reviewed 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, the staff found this exception to be acceptable.

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

Enhancement

[Parameters Monitored/Inspected] 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.

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 staff 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 staff found this enhancement to be acceptable, as such changes to the applicant’s program will provide additional assurance that the effects of aging will be adequately managed.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.13 for which the applicant claims consistency with GALL AMP XI.M21 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.13, the applicant stated that, for the Closed-Cycle Cooling Water System Program, 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 Heating and Ventilation (HTV) System (steam traps, temperature control valve packing/gaskets, heating coils, and fittings). These leaks have been isolated and corrected, 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. Procedural requirements for chemistry limits are established based on EPRI and industry standards and routinely monitored. A condition report was entered into the site Corrective Action Program because a liquid penetrant examination showed a pin-hole leak on the top side of a sampling line at the tubing end of a tubing to insert fillet weld (sampling line connected on top of a Reactor Building closed Cooling Water (RBC) heat exchanger). Inadequate original welding of the connection was

determined to be the cause for the leak. Adjacent and external surfaces did not show pitting or other signs of distress, suggesting this was a localized effect. The affected section of stainless steel tubing was removed and replaced.

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

On the basis of its review of the above industry and plant-specific operating experience and of discussions with the applicant's technical staff, the project team concludes that the applicant’s closed-cycle cooling water program, AMP B2.1.13, will adequately manage the aging effects that are identified in the MNGP LRA, for which this AMP is credited.

USAR Supplement. In a letter dated June 10, 2005, Enclosure 2, Section A2.1.13, the applicant provided the USAR supplement for the Closed-Cycle Cooling Water System Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Section A2.1.13 also stated 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.

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

3.0.3.2.13 Compressed Air Monitoring Program

Summary of Technical Information in the Application. In LRA Section B2.1.14, the applicant described the Compressed Air Monitoring Program, stating that this is an existing program that is consistent, with exceptions and enhancements, with GALL AMP XI.M24, “Compressed Air Monitoring.” The MNGP Compressed Air Monitoring Program consists of inspection, monitoring, and testing of the instrument and service air system.

Staff Evaluation. During its audit and review, the staff confirmed the applicant’s claim of consistency with the GALL Report. Details of the staff’s audit evaluation of this AMP are documented in the MNGP audit and review report. The staff reviewed the exceptions and enhancements and the associated justifications to determine whether the AMP, with the

exceptions and enhancements, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M24.

The staff reviewed those portions of the MNGP AMP B2.1.14, "Compressed Air Monitoring Program," which the applicant claims are consistent with GALL AMP XI.M24, "Compressed Air Monitoring," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the exceptions and enhancements as described below.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M24 in the GALL Report.

Exception 1

[Parameters Monitored/Inspected] 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.

<u>Exception</u>: 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.

On the basis of its review of the NRC, EPRI, and other industry guidelines and standards, the staff 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. Details of the staff review were documented in the audit and review 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, the staff found this exception to be acceptable.

Exception 2

[Detection of Aging Effects] 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.

<u>Exception</u>: 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 staff 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 staff 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 staff 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 staff 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 staff 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, the staff found this exception to be acceptable.

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

Enhancement 1

[Scope of Program] 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.

Enhancement: 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 staff 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 staff 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 staff found 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, the staff found this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 2

[Detection of Aging Effects] 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.

Enhancement: 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 staff 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 staff 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, the staff found this enhancement to be acceptable as such changes to the applicant’s program will provide additional assurance that the effects of aging will be adequately managed.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.14 for which the applicant claims consistency with GALL AMP XI.M24 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.14, the applicant stated that the Compressed Air Monitoring 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, where a number of system leaks were identified, and repaired. Unavailability targets for this system are well within plant established goals.

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

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

USAR Supplement. In a letter dated June 10, 2005, Enclosure 2, Section A2.1.14, the applicant provided the USAR supplement for the Compressed Air Monitoring Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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.

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

3.0.3.2.14 Environmental Qualification of Electrical Components Program

Summary of Technical Information in the Application. In LRA Section B2.1.16, the applicant described the "Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program," stating that this is a new program that is consistent, with exceptions, with GALL AMP XI.E2, "Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits." 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. 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 since it may contribute to inaccuracies in the instrument loop.

In this aging management program, routine calibration tests performed as part of the plant surveillance test program are 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 is performed on the loop, including the instrumentation cable. 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, cable system testing will be performed. 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.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.E2.

The staff 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 Program," which the applicant claims are consistent with GALL AMP XI.E2, "Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMPwith the exception as described below.

In the LRA, the applicant stated the following exception to the program elements listed for AMP XI.E2 in the GALL Report.

Exception

[Parameters Monitored/Inspected, Detection of Aging Effects, and Acceptance Criteria] 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.

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 applicant in the LRA stated for those cables not tested as part of Technical Specification surveillance procedure, the program will periodically test the cable insulation. The staff reviewed the applicant’s exception and found 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, the staff found this exception to be acceptable.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.16 for which the applicant claims consistency with GALL AMP XI.E2 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.16, the applicant stated that the Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program is a new program and as such does not have plant-specific operating experience. 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 staff asked the applicant how operating experience is captured. The applicant stated 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 staff reviewed the applicant’s response and determined that it is acceptable.

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

USAR Supplement. In LRA Section A2.1.16, the applicant provided the USAR supplement for the Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits program.

Subsequently, by letter dated June 10, 2005, 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 staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.2.15 Fire Protection Program

Summary of Technical Information in the Application. In LRA Section B2.1.17, the applicant described the Fire Protection Program, stating that this is an existing program that is consistent, with exception and enhancement, with GALL AMP XI.M26, “Fire Protection.” 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 includes periodic inspection and testing of the cable spreading room halon fire suppression system.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M26.
The staff reviewed those portions of the MNGP AMP B2.1.17, "Fire Protection Program," which the applicant claims are consistent with GALL AMP XI.M26, "Fire Protection," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the exception and enhancement as described below.

In the LRA, the applicant stated the following exception to the program elements listed for AMP XI.M26 in the GALL Report.

Exception

[Parameters Monitored/Inspected] 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.

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 applicant stated, in the MNGP LRA,Section B2.1.17 and the associated bases document 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 staff interviews, MNGP personnel provided further information including the MNGP – System Health Report – Fire Protection.

MNGP technical staff stated that they reviewed industry operating experience, performed 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 stated that the 18-month frequency is acceptable.

The staff interviewed the applicant for parameters monitored/inspected as part of Fire Protection relative to the guidelines for frequency of inspections. The applicant stated 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 percent of each type of seal, which is consistent with GALL Report recommendations. The staff also reviewed other inspection criteria related to fire doors, the diesel driven fire pump, and the halon/carbon dioxide systems. The staff found 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.

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

Enhancement

[Detection of Aging Effects] 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 percent, 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.

<u>Enhancement</u>: 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 staff found 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 staff evaluation of the above enhancement and review of the operating experience for the MNGP AMP B2.1.17 program, the staff found this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.17 for which the applicant claims consistency with GALL AMP XI.M26 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.17, the applicant stated that, through the use of established plant surveillances and procedures, barriers and other features are inspected on a periodic basis. The most recent self-assessment conducted in December 2000, 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 Corrective 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 had made significant progress in addressing 2002 inspection findings.

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

On the basis of its review of the above operating experience and discussions with the applicant's technical staff, the staff concluded that the applicant's AMP B2.1.17 will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

USAR Supplement. In a letter dated June 10, 2005, Enclosure 2, Section A2.1.17, the applicant provided the USAR supplement for the Fire Protection Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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.

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

3.0.3.2.16 Fire Water System Program

Summary of Technical Information in the Application. In LRA Section B2.1.18, the applicant described the Fire Water System Program, stating that this is an existing program that is consistent, with enhancement, with GALL AMP XI.M27, "Fire Water System." The Fire Water System 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, a periodic full flow flush test and system performance test are conducted. The system is also normally maintained at required operating pressure and is monitored so that loss of system pressure is immediately detected and corrective actions initiated.

Staff Evaluation. During its audit and review, the staff confirmed the applicant's claim of consistency with the GALL Report. Details of the staff's audit evaluation of this AMP are documented in the MNGP audit and review report. The staff reviewed the enhancement and

the associated justifications to determine whether the AMP, with the enhancement, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M27.

The staff reviewed those portions of the MNGP AMP B2.1.18, "Fire Water System Program," which the applicant claims are consistent with GALL AMP XI.M27, "Fire Water System," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the enhancement as described below.

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

Enhancement

[Detection of Aging Effects] 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.

<u>Enhancement</u>: 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 staff found 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, the staff found this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.18 for which the applicant claims consistency with GALL AMP XI.M27 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.18, the applicant explained that through the use of established plant surveillances and procedures, the fire water system is periodically inspected, tested, flushed, and maintained. Industry and plant experience is evaluated for system performance impacts. Performance issues are documented and evaluated in the site Corrective Action program. System availability has had 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. One fire protection system walk down conducted 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, which was trended by the Fire Protection System Engineer. Repacking would be accomplished when necessary. The second concern was with a seal leak on the FP Jockey Pump. The mechanical seal was replaced under the work control process.

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

On the basis of its review of the above operating experience and discussions with the applicant's technical staff, the project team concludes that the applicant's AMP B2.1.18 will adequately manage the aging effects that are identified in MNGP LRA for which this AMP is credited.

USAR Supplement. In a letter dated June 10, 2005, Enclosure 2, Section A2.1.18, the applicant provided the USAR Supplement for the Fire Water System Program. The staff reviewed this section and determined that the information in the USAR Supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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.

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 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.

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.

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

3.0.3.2.17 Fuel Oil Chemistry Program

Summary of Technical Information in the Application. In LRA Section B2.1.20, the applicant described the Fuel Oil Chemistry Program, stating that this is an existing program that is consistent, with exceptions and enhancements, with GALL AMP XI.M30, "Fuel Oil Chemistry." 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.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M30.

The staff reviewed those portions of the MNGP AMP B2.1.20, "Fuel Oil Chemistry Program," which the applicant claims are consistent with GALL AMP XI.M30, "Fuel Oil Chemistry," and

found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the exceptions and enhancements as described below.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M30 in the GALL Report.

Exception 1

[Preventive Actions] 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.

<u>Exception</u>: The MNGP Fuel Oil Chemistry Program does not currently use biocides, stabilizers, and corrosion inhibitors.

The staff review found 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, 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, the staff found this exception to be acceptable.

Exception 2

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

> The 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.

Exception: ASTM D 2709 and ASTM D 2276 are not utilized at the MNGP.

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 staff review found 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, the staff found this exception to be acceptable.

Exception 3

[Acceptance Criteria] 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.

Exception: ASTM D 2709 and ASTM D 2276 are not utilized at MNGP.

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 staff 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, the staff found this exception to be acceptable.

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

Enhancement 1

[Scope of Program] 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.

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 staff review of various documents on site (including a comparison of the GALL-recommended ASTMs with those used at MNGP, the program basis document, 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, the staff found this enhancement to be acceptable as such changes to the applicant’s program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 2

[Preventive Actions] 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.

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 staff review of various documents on site (including a comparison of the GALL-recommended ASTMs with those used at MNGP, the program basis document, 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, the staff found this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 3

[Detection of Aging Effects] 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.

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 staff review of various documents on site (including a comparison of the GALL-recommended ASTMs with those used at MNGP, the program basis document, 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, the staff found this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.20 for which the applicant claims consistency with GALL AMP XI.M30 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.20, the applicant stated that 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 staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

On the basis of its review of the above industry and plant-specific operating experience and on discussions with the applicant's technical staff, the staff concluded that MNGP AMP B2.1.20 adequately manages the aging effects that are identified in the LRA for which this AMP is credited.

USAR Supplement. In a letter dated June 10, 2005, Enclosure 2, Section A2.1.20, the applicant provided the USAR Supplement for the Fuel Oil Chemistry Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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, microbiologicaly 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.

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

3.0.3.2.18 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program

Summary of Technical Information in the Application. In LRA Section B2.1.22, the applicant described the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program, stating that this is an existing program that is consistent, with

exception and enhancement, with GALL AMP XI.M23, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems.” The Inspection Of Overhead Heavy Load & Light Load (Related To Refueling) Handling Systems 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 & Light Load (Related To Refueling) Handling Systems Program provides for visual and NDE inspections of load handling components within the scope of license renewal. Functional tests are performed to assure their integrity. The cranes also comply with the maintenance rule requirements provided in 10 CFR 50.65.

<u>Staff Evaluation</u>. During its audit and review, the staff confirmed the applicant’s claim of consistency with the GALL Report. Details of the staff’s audit evaluation of this AMP are documented in the MNGP audit and review report. The staff reviewed the exception and enhancement and the associated justifications to determine whether the AMP, with the exception and enhancement, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff’s MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M23.

The staff reviewed those portions of the MNGP AMP B2.1.22, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program," which the applicant claims are consistent with GALL AMP XI.M23, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant’s AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant’s LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the exception and enhancement as described below.

In the LRA, the applicant stated the following exception to the program elements listed for AMP XI.M23 in the GALL Report.

Exception

[Parameters Monitored/Inspected] 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.

<u>Exception</u>: 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 staff 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 staff 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, the staff found this exception to be acceptable.

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

Enhancement

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

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

The program will be enhanced to specify a five-year inspection frequency for the fuel preparation machines.

The staff review of various documents on site (including a comparison of the GALL recommendations with the proposed enhancements at MNGP, the program basis document, 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, the staff found this enhancement to be acceptable as such changes to the applicant’s program will provide additional assurance that the effects of aging will be adequately managed.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.22 for which the applicant claims consistency with GALL AMP XI.M23 are consistent with the GALL Report.

<u>Operating Experience</u>. In LRA Section B2.1.22, the applicant stated 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 device components have 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 was repaired and painted.

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

On the basis of its review of the above industry and plant-specific operating experience and on discussions with the applicant's technical staff, the staff concluded that MNGP AMP B2.1.22 will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

USAR Supplement. In a letter dated June 10, 2005, Enclosure 2, Section A2.1.22, the applicant provided the USAR supplement for the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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.

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

3.0.3.2.19 Plant Chemistry Program

Summary of Technical Information in the Application. In LRA Section B2.1.25, the applicant described the Plant Chemistry Program, stating that this is an existing program that is consistent, with exceptions, with GALL AMP XI.M2, "Water Chemistry." 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., chlorides and sulfates) 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.

<u>Staff Evaluation</u>. During its audit and review, the staff confirmed the applicant’s claim of consistency with the GALL Report. Details of the staff’s audit evaluation of this AMP are documented in the MNGP audit and review report. The staff reviewed the exceptions and the associated justifications to determine whether the AMP, with the exceptions, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff’s MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M2.

The staff reviewed those portions of the MNGP AMP B2.1.25, “Plant Chemistry Program," which the applicant claims are consistent with GALL AMP XI.M2, “Water Chemistry," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant’s AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant’s LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the exceptions as described below.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M2 in the GALL Report.

Exception 1

[Scope of Program] 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.

<u>Exception</u>: 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 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 staff 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 staff 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 staff determined 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 staff found the exception to be acceptable.

Exception 2

[Parameters Monitored/Inspected] 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

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 staff 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 staff found 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 for the MNGP AMP B2.1.25 program, the staff found this exception to be acceptable.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.25 for which the applicant claims consistency with GALL AMP XI.M2 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.25, the applicant stated that 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. Industry experience related to IGSCC issues 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. 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 site. Recent external and internal assessments have identified chemistry trending as a strength and personnel knowledge as good. These conclusions are based on a review 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 staff reviewed the operating experience provided in the LRA and interviewed the applicant's technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

On the basis of its review of the above operating experience and discussions with the applicant's technical staff, the staff concluded that the applicant's AMP B2.1.25 will adequately manage the aging effects that are identified in the LRA for which this AMP is credited.

USAR Supplement. In LRA Section A2.1.25, the applicant provided the USAR supplement for the Plant Chemistry Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.2.20 Protective Coating Monitoring & Maintenance Program

Summary of Technical Information in the Application. In LRA Section B2.1.27, the applicant described the Protective Coating Monitoring & Maintenance Program, stating that this is an existing program that is consistent, with enhancements, with GALL AMP XI.S8, "Protective Coating Monitoring and Maintenance Program." The 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.

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

documented in the MNGP audit and review report. The staff reviewed the enhancements and the associated justifications to determine whether the AMP, with the enhancements, remains adequate to manage the aging effects for which it is credited.

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.S8.

The staff reviewed those portions of the MNGP AMP B2.1.27, "Protective Coating Monitoring and Maintenance Program," which the applicant claims are consistent with GALL AMP XI.S8, "Protective Coating Monitoring and Maintenance Program," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the enhancements as described below.

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

Enhancement 1

[Scope of Program] 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.

<u>Enhancement</u>: The MNGP Protective Coating Maintenance and Monitoring Program procedures will be updated to include inspection of all accessible painted surfaces inside containment.

The staff 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 staff 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, the staff found this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 2

[Detection of Aging Effects] 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.

Enhancement: Prior to the period of extended operation all coating inspectors will meet the requirements of ANSI N45.2.6.

The staff 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 staff 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, 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 staff 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, the staff found this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 3

[Monitoring and Trending] The GALL Report 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.

Enhancement: Include a pre-inspection review of the previous two inspection reports so that trends can be identified.

The staff 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, the staff found this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 4

[Acceptance Criteria] 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.

Enhancement: Implementation Procedures will be revised to include provisions for analysis of suspected reasons for coating failure.

The staff 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, the staff found this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.27 for which the applicant claims consistency with GALL AMP XI.S8 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.27, the applicant stated 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 included. 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.

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

On the basis of its review of the above industry and plant-specific operating experience and on discussions with the applicant's technical staff, the staff concluded that MNGP AMP B2.1.27 adequately manages the aging effects that are identified in the LRA for which this AMP is credited.

USAR Supplement. In a letter dated June 10, 2005, Enclosure 2, Section A2.1.27, the applicant provided the USAR supplement for the Protective Coating Monitoring and Maintenance Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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.

3. Implementation procedures will be revised to include provisions for analysis of suspected reasons for coating failure.

In a letter dated August 11, 2005, the applicant stated that prior to the period of extended operation, coating inspectors will meet the requirements of ANSI N45.2.6. This commitment will be documented in the first Annual LRA Supplement. This issue is identified as a Confirmatory Item 3.0.3.2.20-1.

Conclusion. On the basis of its review and audit of the applicant's Protective Coating Monitoring and Maintenance Program, the staff determined that those program elements for which the applicant claimed consistency with the GALL Report are consistent with the GALL Report. Also, the staff reviewed the enhancements and confirmed that the implementation of the enhancements prior to the period of extended operation would result in the existing AMP

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

3.0.3.2.21 Reactor Vessel Surveillance Program

Summary of Technical Information in the Application. In LRA Section B2.1.29, the applicant described the Reactor Vessel Surveillance Program, stating that this is an existing program that is consistent, with enhancement, with GALL AMP XI.M31, “Reactor Vessel Surveillance.” The MNGP Reactor Vessel Surveillance Program is part of the Boiling Water Reactor Vessel Internals Project (BWRVIP) Integrated Surveillance Program (ISP) that uses data from BWR member surveillance programs to select the “best” representative material to monitor radiation embrittlement for a particular plant. The BWRVIP ISP monitors capsule test results from various member plants. This is consistent with the methodology allowed by the GALL Report. The MNGP Reactor Vessel Surveillance Program is required by 10 CFR 50, Appendix H. The scope of the Reactor Vessel Surveillance Program is described by the BWRVIP ISP guidance. The ISP capsule removal schedule is included in BWRVIP-86-A and its technical basis is described in BWRVIP-78. The NRC in a Safety Evaluation (SE) to the BWRVIP, dated February 1, 2002, approved the ISP. This Safety Evaluation concluded that the ISP, if implemented in accordance with the conditions in the SE, is an acceptable alternative to all existing BWR plant-specific RPV surveillance programs for the purpose of maintaining compliance with the requirements of Appendix H to 10 CFR Part 50 through the end of current facility 40-year operating licenses.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff’s MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M31.

<INSERT Supplemental Information Provided by Tech Staff (EMCB-A/Elliot)>

The staff reviewed those portions of the MNGP AMP B2.1.29, “Reactor Vessel Surveillance Program," which the applicant claims are consistent with GALL AMP XI.M31, “Reactor Vessel Surveillance," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant’s AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant’s LRA AMP acceptable because it conformed to the recommended GALL Report AMP.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.29 for

which the applicant claims consistency with GALL AMP XI.M31 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.29, the applicant stated that test specimens were taken from the reactor vessel in May 1984 and sent to a national laboratory for testing. Testing concluded there was sufficient material margin using Regulatory Guide criteria available at the time. The MNGP participates in the BWRVIP ISP to ensure the program meets accepted industry practices. The NRC has accepted the ISP methodology for monitoring radiation embrittlement at BWRVIP plants, which includes MNGP.

<INSERT Supplemental Information Provided by Tech Staff (EMCB-A/Elliot)>

USAR Supplement. In LRA Section A2.1.29, the applicant provided the USAR supplement for the Reactor Vessel Surveillance Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.2.22 Selective Leaching of Materials Program

Summary of Technical Information in the Application. In LRA Section B2.1.30, the applicant described the Selective Leaching of Materials Program, stating that this is a new program that is consistent, with exception, with GALL AMP XI.M33, "Selective Leaching of Materials." 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.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff's MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.M33.

The staff reviewed those portions of the MNGP AMP B2.1.30, "Selective Leaching of Materials Program," which the applicant claims are consistent with GALL AMP XI.M33, "Selective Leaching of Materials," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant's AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant's LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the exceptions as described below.

In the LRA, the applicant stated the following exceptions to the program elements listed for AMP XI.M33 in the GALL Report.

Exceptions 1 and 2

[Detection of Aging Effects] 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.

<u>Exception 1</u>: Hardness testing, other than Brinell hardness testing, may be used at the MNGP to identify the presence of selective leaching of material.

<u>Exception 2</u>: 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 staff discussed these exceptions with the applicant's technical staff. Regarding Exception 1, the staff concurred that Brinell hardness testing is one of several methodologies that are currently being used and it is only a GALL recommendation. The staff found the applicant's position acceptable. Regarding Exception 2, the staff asked the applicant to provide a clarification pertaining to the use of qualitative methods versus hardness testing. In particular, the staff was concerned that metallurgical and other methods be used in addition to VT-1.

Through a letter dated August 11, 2005, the applicant stated 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 staff found the applicant's position acceptable.

On the basis of its review of operating experience for the Selective Leaching Program and the applicant's response in the letter dated August 11, 2005, the staff found these exceptions to be acceptable.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.30 for which the applicant claims consistency with GALL AMP XI.M33 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.30, that applicant stated that the Selective Leaching of Materials Program is a new program and thus does not have any operating experience.

During the audit and review, the staff 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 staff reviewed the applicant's response and determined that it is acceptable.

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

USAR Supplement. In LRA Section A2.1.30, the applicant provided the USAR supplement for the Selective Leaching of Materials Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.3.2.23 Structures Monitoring Program

Summary of Technical Information in the Application. In LRA Section B2.1.31, the applicant described the Structures Monitoring Program, stating that this is an existing program that is consistent, with enhancements, with GALL AMP 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. As recommended by NUREG-1801, XI.S7, RG 1.127, “Inspection of Water-Control Structures Associated with Nuclear Power Plants,” the inspection of water control structures is included in the Structures Monitoring Program. The only water control structure within the scope of license renewal is the intake structure. 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. In addition, special settlement checks of the diesel fuel oil transfer house are performed outside the maintenance rule inspections. The Structures Monitoring Program does not rely upon protective coatings to manage the effects of aging.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff’s MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP XI.S6.

The staff reviewed those portions of the MNGP AMP B2.1.31, “Structures Monitoring Program," which the applicant claims are consistent with GALL AMP XI.S6, “Structures Monitoring Program," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant’s AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant’s LRA AMP acceptable because

it conformed to the recommended GALL Report AMP with the enhancements as described below.

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

Enhancement 1

[Scope of 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.

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.

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 and based on satisfying the GALL recommendations as discussed above, the staff found this enhancement to be acceptable as such changes to the applicant’s program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 2

[Scope of Program] The GALL Report identifies the following recommendations for “scope of program” program element associated with the enhancement:

> The Water Control structures includes intake structures.

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 applicant stated, in the LRA, that the Structures Monitoring Program includes separate inspections of the underwater portions of the Intake Structure. Under Scope of Program, the applicant stated that the program also provides inspection requirements to manage aging

effects as described in Parameters Monitored Inspected. As documented in the audit and review report, the applicant performs structural inspections of the service water bays and will include more detailed inspection criteria. In addition, the applicant will perform structural inspections of the submerged portions of the intake structure 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 and based on satisfying the GALL recommendations as discussed above, the staff found this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 3

[Parameters Monitored/Inspected] 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.

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 applicant stated, in the LRA, that existing procedures will be enhanced to include the monitoring/inspection parameters for all structural components within the scope of license renewal. 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 and based on satisfying the GALL recommendations as discussed above, the staff found this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 4

[Parameters Monitored/Inspected] 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.

Enhancement: The Structures Monitoring Program will be enhanced to include a requirement to sample ground water for pH, chloride concentration and sulfate concentration.

The applicant stated, in the LRA, that to ensure that the soil environment has remained non aggressive, the structures monitoring program will be enhanced to include periodic ground-water 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 and based on satisfying the GALL recommendations as discussed above, the staff found this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 5

[Parameters Monitored/Inspected] 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.

Enhancement: The Structures Monitoring Program will be enhanced to include concrete evaluations of inaccessible areas if degradation of accessible areas is detected.

The applicant stated, in the 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 and based on satisfying the GALL recommendations as discussed above, the staff found this enhancement to be acceptable as such changes to the applicant's program will provide additional assurance that the effects of aging will be adequately managed.

Enhancement 6

[Acceptance Criteria] 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.

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 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 and based on satisfying the GALL recommendations as discussed above, the staff found this enhancement to be acceptable as such changes to the applicant’s program will provide additional assurance that the effects of aging will be adequately managed.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B2.1.31 for which the applicant claims consistency with GALL AMP XI.S6 are consistent with the GALL Report.

Operating Experience. In LRA Section B2.1.31, the applicant stated 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 staff reviewed the operating experience provided in the LRA and interviewed the applicant’s technical staff to confirm that the plant-specific operating experience did not reveal any degradation not bounded by industry experience.

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

USAR Supplement. In a letter dated June 10, 2005, Enclosure 2, Section A2.1.31, the applicant provided the USAR supplement for the Structures Monitoring Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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.

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

3.0.3.2.24 Metal Fatigue of the Reactor Coolant Pressure Boundary Program

Summary of Technical Information in the Application. In LRA Section B3.2, the applicant described the Metal Fatigue of the Reactor Coolant Pressure Boundary Program, stating that

this is an existing program that is consistent, with enhancement, with GALL AMP X.M1, “Metal Fatigue of Reactor Coolant Pressure Boundary.” The MNGP Metal Fatigue of the Reactor Coolant Pressure Boundary aging management 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 impact 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.

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

The staff interviewed the applicant's technical staff and reviewed, in whole or in part, the documents, as documented in the staff’s MNGP audit and review report, which provided an assessment of the AMP elements' consistency with GALL AMP X.M1.

The staff reviewed those portions of the MNGP AMP B3.2, “Metal Fatigue of the Reactor Coolant Pressure Boundary Program," which the applicant claims are consistent with GALL AMP X.M1, “Metal Fatigue of the Reactor Coolant Pressure Boundary," and found that they were consistent with the GALL AMP. Furthermore, the staff concluded that the applicant’s AMP provided reasonable assurance that the program will adequately manage plant aging. The staff found the applicant’s LRA AMP acceptable because it conformed to the recommended GALL Report AMP with the enhancement as described below.

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

Enhancement

[Scope of Program] 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.

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 staff 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 “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 staff found 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 staff 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 staff 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 staff found the applicant’s response to be acceptable.

On the basis of its review of the program elements, and on discussion with the applicant's technical staff, the staff concluded that those program elements in MNGP AMP B3.2 for which the applicant claims consistency with GALL AMP X.M1 are consistent with the GALL Report.

<u>Operating Experience</u>. In LRA Section B3.2, the applicant stated that the MNGP technical staff monitored industry operating experience through peer groups, industry information (e.g., INs, LERs, SILs, etc.), and by communications with the subject matter experts from other plants. Information from these sources are evaluated for impact on the MNGP Reactor Coolant Pressure Boundary Metal Fatigue Program. In addition, the MNGP technical staff updated internal operating experience to account for operating cycles and their effect on fatigue of limiting components on a frequency of a least once per refueling cycle. 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. For example, in May 1999, MNGP experienced several transients as indicated by feedwater and reactor water cleanup flow data. Subsequent review concluded that these transients could have an

impact on feedwater nozzle fatigue usage and that they did not conform to the transient descriptions that would normally be considered in the thermal fatigue monitoring program. An evaluation of these transients found that the effect on fatigue was not significant (0.003 addition). The results, however, were incorporated into the thermal fatigue monitoring program which is updated at least once every refueling cycle. This operating experience is documented in the MNGP Corrective Action Program.

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

On the basis of its 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 staff concluded 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.

USAR Supplement. In a letter dated June 10, 2005, Enclosure 2, Section A4.2, the applicant provided the USAR supplement for the Metal Fatigue of the Reactor Coolant Pressure Boundary Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

In the same letter, in Section A.5, Commitments, item 52, the applicant identified a commitment that stated, " Incorporate requirements for inclusion of NUREG/CR-6260 locations in implementing procedures for the MNGP Thermal Fatigue Monitoring Program." However, this commitment was not captured in the Appendix A, USAR supplement in Section A4.2. This issue is identified as a Confirmatory Item 3.0.3.2.24-1.

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

3.0.3.3 AMPs that are Not Consistent With or Not Addressed in the GALL Report

In LRA Appendix B, the applicant identified that the following AMPs were plant-specific:

- Bus Duct Inspection Program (B2.1.6)
- System Condition Monitoring Program (B2.1.32)

For AMPs that are not consistent with or not addressed by the GALL Report, the staff performed a complete review of the AMPs to determine if they were adequate to monitor or manage aging. The staff's review of these plant-specific AMPs is documented in the following sections of this SER.

3.0.3.3.1 Bus Duct Inspection Program

Summary of Technical Information in the Application. In LRA Section B2.1.6, the applicant described the Bus Duct Inspection Program, stating that this is a new, plant-specific program. Non-segregated bus duct insulation aging degradation from ingress of moisture or contaminants (dust and debris), or heat or radiation in the presence of oxygen, causes insulation surface anomalies. In managing this aspect of the aging management program, visual inspection of interior portions of bus ducts will be performed to identify aging degradation of insulating and metallic components and water/debris intrusion. The external portions of bus ducts and structural supports will be inspected in accordance with a plant-specific structural monitoring program. Additionally, bus ducts exposed to appreciable ohmic heating during operation may experience loosening of bolted connections. In managing this aspect of the aging management program, bolted connections at sample sections of the buses in the bus ducts will be checked for proper torque, or the bolted joints will be checked to ensure low resistance.

Staff Evaluation. In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in LRA Section B2.1.6, regarding the applicant's demonstration of the Bus Duct Inspection Program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

<INSERT Supplemental Information Provided by Tech Staff (EBIB/Knox)>

Operating Experience. In LRA Section B2.1.6, the applicant stated that the Bus Duct Inspection Program is a new program and no site operating experience exists. Industry operating experience has demonstrated that the failures of bus ducts are caused by cracked insulation of the bus combined with moisture or debris buildup internal to the bus ducts. It has also been shown that bus duct internals exposed to appreciable ohmic heating during operation may experience loosening of bolted connections related to repeated cycling of connected loads.

<INSERT Supplemental Information Provided by Tech Staff (EBIB/Knox)>

USAR Supplement. In LRA Section A2.1.6, the applicant provided the USAR supplement for the Bus Duct Inspection Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

Conclusion. On the basis of its review and audit of the applicant's Bus Duct Inspection Program, the staff concluded that the applicant demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also

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

3.0.3.3.2 System Condition Monitoring Program

Summary of Technical Information in the Application. In LRA Section B2.1.32, the applicant described the System Condition Monitoring Program, stating that this is an existing, plant-specific program. The System Condition Monitoring Program is based on system engineer monitoring. Although many monitoring activities are being performed at MNGP, this AMP brings aging management into the scope of the monitoring activities. Other groups augment this program by identifying and reporting adverse material conditions via the corrective action process or work control process. This monitoring consists of system-level performance monitoring, inspections and walkdowns, health and status reporting, and preventive maintenance. This program will be enhanced to include specific activities and criteria for managing age related degradation for SSCs within license renewal scope. This program manages aging effects for normally accessible external surfaces of piping, tanks, hangers/supports, racks, panels, 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.

Staff Evaluation. In accordance with 10 CFR 54.21(a)(3), the staff reviewed the information included in LRA Section B2.1.32, regarding the applicant's demonstration of the System Condition Monitoring Program to ensure that the effects of aging, as discussed above, will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation.

<INSERT Supplemental Information Provided by Tech Staff (EMEB-B/Strnisha)>

Operating Experience. In LRA Section B2.1.32, the applicant stated that the System Condition Monitoring Program is based on routine walkdowns performed by qualified system engineers. Walkdown progress is monitored on a monthly basis as an Engineering Department performance indicator with a goal of 90 percent completed as scheduled. Since data gathering began in May 2003, 100 percent of the monthly scheduled walk downs have been completed as scheduled (through August 2004). Numerous examples were noted where system engineers documented needed corrective actions through minor maintenance tasks, work orders, or Action Requests (entered into the site Corrective Action program). System Health Reports are maintained by system engineers as one mechanism to track the progress of system performance, outstanding work, and results of operating experience reviews performed by the system engineers.

<INSERT Supplemental Information Provided by Tech Staff (EMEB-B/Strnisha)>

USAR Supplement. In LRA Section A2.1.32, the applicant provided the USAR supplement for the System Condition Monitoring Program. The staff reviewed this section and determined that the information in the USAR supplement provides an adequate summary description of the program, as required by 10 CFR 54.21(d).

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

3.0.4 Quality Assurance Program Attributes Integral to Aging Management Programs

Pursuant to 10 CFR 54.21(a)(3), a license renewal applicant is required to demonstrate that the effects of aging on SCs subject to an AMR will be adequately managed so that their intended functions will be maintained consistent with the CLB for the period of extended operation. SRP-LR, Branch Technical Position RLSB-1, "Aging Management Review – Generic," describes 10 attributes of an acceptable AMP. Three of these 10 attributes are associated with the QA activities of corrective action, confirmation process, and administrative control. Branch Technical Position RLSB-1 Table A.1-1, "Elements of an Aging Management Program for License Renewal," provides the following description of these quality attributes:

- corrective actions, including root cause determination and prevention of recurrence, should be timely
- the confirmation process should ensure that preventive actions are adequate and that appropriate corrective actions have been completed and are effective
- administrative controls should provide a formal review and approval process

SRP-LR, Branch Technical Position IQMB-1, "Quality Assurance for Aging Management Programs," noted that those aspects of the AMP that affect the quality of safety-related SSCs are subject to the QA requirements of 10 CFR Part 50, Appendix B. Additionally, for nonsafety-related SCs subject to an AMR, the existing 10 CFR Part 50, Appendix B QA program may be used by the applicant to address the elements of corrective action, confirmation process, and administrative control. Branch Technical Position IQMB-1 provides the following guidance with regard to the QA attributes of AMPs:

- Safety-related SCs are subject to 10 CFR Part 50, Appendix B, requirements which are adequate to address all quality-related aspects of an AMP consistent with the CLB of the facility for the period of extended operation.
- For nonsafety-related SCs that are subject to an AMR, an applicant has an option to expand the scope of its 10 CFR Part 50, Appendix B, program to include these SCs to address corrective action, confirmation process, and administrative control for aging management during the period of extended operation. In this case, the applicant should document such commitment in the USAR supplement in accordance with 10 CFR 54.21(d).

3.0.4.1 Summary of Technical Information in the Application

<INSERT Supplemental Information Provided by Tech Staff (IPSB/Tingen)>

3.0.4.2 Staff Evaluation

<INSERT Supplemental Information Provided by Tech Staff (IPSB/Tingen)>

3.0.4.3 Conclusion

<INSERT Supplemental Information Provided by Tech Staff (IPSB/Tingen)>

3.1 Aging Management of Reactor Coolant System

This section of the SER documents the staff's review of the applicant's aging management review (AMR) results for the reactor coolant system components and component groups associated with the following systems:

- reactor head vent system
- reactor pressure vessel
- reactor pressure vessel internals
- reactor recirculation system
- reactor vessel instrumentation

3.1.1 Summary of Technical Information in the Application

In LRA Section 3.1, the applicant provided AMR results for the reactor coolant system components and component groups. In LRA Table 3.1.1, "Summary of Aging Management Evaluations in Chapter IV of NUREG-1801 for Reactor Coolant System," the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the reactor vessel, internals, and reactor coolant system components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of aging effects requiring management (AERMs). These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.1.2 Staff Evaluation

The staff reviewed LRA Section 3.1 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the reactor coolant system components that are within the scope of license renewal and subject to an AMR 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).

Also, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMRs. The staff's evaluations of the AMPs are documented in Section 3.0.3 of this SER.

Details of the staff's audit evaluation are documented in the MNGP audit and review report and are summarized in Section 3.1.2.1 of this SER.

The staff also performed an onsite audit of those selected AMRs that were consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.1.2.2 of the SRP-LR. The staff's audit evaluations are documented in the MNGP audit and review report and are summarized in Section 3.1.2.2 of this SER.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that were not consistent with, or not addressed in, the GALL Report. The audit and technical review included evaluating whether all plausible aging effects were identified and evaluating whether the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluations are documented in the MNGP audit and review report and are summarized in Section 3.1.2.3 of this SER. The staff's evaluation of its technical review is also documented in Section 3.1.2.3 of this SER.

Finally, the staff reviewed the AMP summary descriptions in the USAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the reactor coolant system components.

Table 3.1-1 provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.1 that are addressed in the GALL Report.

Table 3.1-1 Staff Evaluation for Reactor Coolant System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff 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 of the RPV and Internals, and Reactor Coolant Pressure Boundary Piping and Components
Steam generator shell assembly (Item Number 3.1.1-02)	Loss of material due to pitting and crevice corrosion	Inservice inspection; water chemistry		Not applicable, PWR only
Isolation condenser (Item Number 3.1.1-03)	Loss of material due to general, pitting, and crevice corrosion	Inservice inspection; water chemistry		Not applicable (See Section 3.1.2.2.2)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Pressure vessel ferritic materials that have a neutron fluence greater than 10^{17} n/cm^2 (E > 1 MeV) (Item Number 3.1.1-04)	Loss of fracture toughness due to neutron irradiation embrittlement	TLAA, evaluated in accordance with Appendix G of 10 CFR 50 and RG 1.99	TLAA	This TLAA is evaluated in Section 4.2, Neutron Embrittlement of the Reactor Pressure Vessel and Internals
Reactor vessel beltline shell and welds (Item Number 3.1.1-05)	Loss of fracture toughness due to neutron irradiation embrittlement	Reactor vessel surveillance	Reactor Vessel Surveillance Program (B2.1.29)	Consistent with GALL, which recommends further evaluation (See Section 3.1.2.2.3)
Westinghouse and B&W baffle/former bolts (Item Number 3.1.1-06)	Loss of fracture toughness due to neutron irradiation embrittlement and void swelling	Plant specific		Not applicable, PWR only
Small-bore reactor coolant system and connected systems piping (Item Number 3.1.1-07)	Crack initiation and growth due to SCC, intergranular SCC, and thermal and mechanical loading	Inservice inspection; water chemistry; one-time inspection	ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2); One-Time Inspection Program (B2.1.23); Plant Chemistry Program (B2.1.25)	Consistent with GALL, 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, intergranular stress corrosion cracking (IGSCC), or cyclic loading	Plant specific	ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2); One-Time Inspection Program (B2.1.23); Plant Chemistry Program (B2.1.25)	Consistent with GALL, 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 stress corrosion cracking (SCC) or cyclic loading	Inservice inspection; water chemistry		Not applicable (See Section 3.1.2.2.4.3)
Vessel shell (Item Number 3.1.1-10)	Crack growth due to cyclic loading	TLAA		Not applicable, PWR only
Reactor internals (Item Number 3.1.1-11)	Changes in dimension due to void swelling	Plant specific		Not applicable, PWR only

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
PWR core support pads, instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the steam generator instruments and drains (Item Number 3.1.1-12)	Crack initiation and growth due to SCC and/or primary water stress corrosion cracking (PWSCC)	Plant specific		Not applicable, PWR only
Cast austenitic stainless steel (CASS) reactor coolant system piping (Item Number 3.1.1-13)	Crack initiation and growth due to SCC	Plant specific		Not applicable, PWR only
Pressurizer instrumentation penetrations and heater sheaths and sleeves made of Ni-alloys (Item Number 3.1.1-14)	Crack initiation and growth due to PWSCC	Inservice inspection; water chemistry		Not applicable, PWR only
Westinghouse and B&W baffle former bolts (Item Number 3.1.1-15)	Crack initiation and growth due to SCC and IASCC	Plant specific		Not applicable, PWR only
Westinghouse and B&W baffle former bolts (Item Number 3.1.1-16)	Loss of preload due to stress relaxation	Plant specific		Not applicable, PWR only
Steam generator feedwater impingement plate and support (Item Number 3.1.1-17)	Loss of section thickness due to erosion	Plant specific		Not applicable, PWR only

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
(Alloy 600) Steam generator tubes, repair sleeves, and plugs (Item Number 3.1.1-18)	Crack initiation and growth due to PWSCC, outside diameter stress corrosion cracking (ODSCC), and/or intergranular attack (IGA) or loss of material due to wastage and pitting corrosion, and fretting and wear; or deformation due to corrosion at tube support plate intersections	Steam generator tubing integrity; water chemistry		Not applicable, PWR only
Tube support lattice bars made of carbon steel (Item Number 3.1.1-19)	Loss of section thickness due to FAC	Plant specific		Not applicable, PWR only
Carbon steel tube support plate (Item Number 3.1.1-20)	Ligament cracking due to corrosion	Plant specific		Not applicable, PWR only
Steam generator feedwater inlet ring and supports (Item Number 3.1.1-21)	Loss of material due to flow-corrosion	Combustion engineering (CE) steam generator feedwater ring inspection		Not applicable, 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	ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2)	Consistent with GALL Report (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

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff 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 Program (B2.1.19)	Consistent with GALL Report for BWR piping and fittings in the Reactor Coolant System. 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 Program (B2.1.4)	Consistent with GALL Report
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 Control Rod Drive Return Line Nozzle Program (B2.1.7), BWR Feedwater Nozzle Program (B2.1.8)	Consistent with GALL Report
Vessel shell attachment welds (Item Number 3.1.1-28)	Crack initiation and growth due to SCC, 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, IGSCC	BWR stress corrosion cracking; water chemistry	ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2); BWR Stress Corrosion Cracking Program (B2.1.10); One-Time Inspection Program (B2.1.23); Plant Chemistry Program (B2.1.25)	Consistent with GALL Report
Penetrations (Item Number 3.1.1-30)	Crack initiation and growth due to SCC, IGSCC, cyclic loading	BWR penetrations; water chemistry	BWR Penetrations Program (B2.1.9), Plant Chemistry Program (B2.1.25)	Consistent with GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Core shroud and core plate, support structure, top guide, core spray lines and spargers, jet pump assemblies, control rod drive housing, nuclear instrumentation guide tubes (Item Number 3.1.1-31)	Crack initiation and growth due to SCC, IGSCC, IASCC	BWR vessel internals; water chemistry	BWR Vessel Internals Program (B2.1.12), 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, IASCC	ASME Section XI inservice inspection; water chemistry	ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2); Plant Chemistry Program (B2.1.25)	Consistent with GALL Report
Jet pump assembly castings; orificed fuel support (Item Number 3.1.1-33)	Loss of fracture toughness due to thermal aging and neutron embrittlement	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
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.
CRD nozzle (Item Number 3.1.1-35)	Crack initiation and growth due to PWSCC	Ni-alloy nozzles and penetrations; water chemistry		Not applicable, PWR only
Reactor vessel nozzles safe ends and CRD housing; reactor coolant system components (except CASS and bolting) (Item Number 3.1.1-36)	Crack initiation and growth due to cyclic loading, and/or SCC and PWSCC	Inservice inspection; water chemistry		Not applicable, PWR only
Reactor vessel internals CASS components (Item Number 3.1.1-37)	Loss of fracture toughness due to thermal aging, neutron irradiation embrittlement, and void swelling	Thermal aging and neutron irradiation embrittlement		Not applicable, PWR only

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
External surfaces of carbon steel components in reactor coolant system pressure boundary (Item Number 3.1.1-38)	Loss of material due to boric acid corrosion	Boric acid corrosion		Not applicable, PWR only
Steam generator secondary manways and handholds (CS) (Item Number 3.1.1-39)	Loss of material due to erosion	Inservice inspection		Not applicable, PWR only
Reactor internals, reactor vessel closure studs, and core support pads (Item Number 3.1.1-40)	Loss of material due to wear	Inservice inspection		Not applicable, PWR only
Pressurizer integral support (Item Number 3.1.1-41)	Crack initiation and growth due to cyclic loading	Inservice inspection		Not applicable, PWR only
Upper and lower internals assembly (Westinghouse) (Item Number 3.1.1-42)	Loss of preload due to stress relaxation	Inservice inspection; loose part and/or neutron noise monitoring		Not applicable, PWR only
Reactor vessel internals in fuel zone region [except Westinghouse and Babcock & Wilcox (B&W) baffle bolts] (Item Number 3.1.1-43)	Loss of fracture toughness due to neutron irradiation embrittlement, and void swelling	PWR vessel internals; water chemistry		Not applicable, PWR only
Steam generator upper and lower heads; tubesheets; primary nozzles and safe ends (Item Number 3.1.1-44)	Crack initiation and growth due to SCC, PWSCC, IASCC	Inservice inspection; water chemistry		Not applicable, PWR only
Vessel internals (except Westinghouse and B&W baffle former bolts) (Item Number 3.1.1-45)	Crack initiation and growth due to SCC and IASCC	PWR vessel internals; water chemistry		Not applicable, PWR only

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Reactor internals (B&W screws and bolts) (Item Number 3.1.1-46)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring		Not applicable, PWR only
Reactor vessel closure studs and stud assembly (Item Number 3.1.1-47)	Loss of material due to wear	Reactor head closure studs		Not applicable, PWR only
Reactor internals (Westinghouse upper and lower internal assemblies; CE bolts and tie rods) (Item Number 3.1.1-48)	Loss of preload due to stress relaxation	Inservice inspection; loose part monitoring		Not applicable, PWR only

The staff's review of the MNGP component groups followed one of several approaches. One approach, documented in Section 3.1.2.1, involves the staff's review of the AMR results for components in the reactor coolant system that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.1.2.2, involves the staff's review of the AMR results for components in the reactor coolant system that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.1.2.3, involves the staff's review of the AMR results for components in the reactor coolant system that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs that are credited to manage or monitor aging effects of the reactor coolant system components is documented in Section 3.0.3 of this SER.

3.1.2.1 AMR Results that are Consistent with the GALL Report

Summary of Technical Information in the Application. In LRA Section 3.1.2.1, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the reactor coolant system components:

- ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2)
- Bolting Integrity Program (B2.1.4)
- BWR Control Rod Drive Return Line Nozzle Program (B2.1.7)
- BWR Feedwater Nozzle Program (B2.1.8)
- BWR Penetrations Program (B2.1.9)

- BWR Stress Corrosion Cracking Program (B2.1.10)
- BWR Vessel ID Attachment Welds Program (B2.1.11)
- BWR Vessel Internals Program (B2.1.12)
- Closed-Cycle Cooling Water System Program (B2.1.13)
- Flow-Accelerated Corrosion Program (B2.1.19)
- One-Time Inspection Program (B2.1.23)
- Plant Chemistry Program (B2.1.25)
- Reactor Head Closure Studs Program (B2.1.28)
- Reactor Vessel Surveillance Program (B2.1.29)
- System Condition Monitoring Program (B2.1.32)
- Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program (B2.1.33)

Staff Evaluation. In LRA Tables 3.1.2-1 through 3.1.2-5, the applicant provided a summary of AMRs for the reactor coolant system components, and identified which AMRs it considered to be consistent with the GALL Report.

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 does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated that the AMR was consistent with the GALL Report.

Note A indicated 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. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicated 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 staff audited these line items to verify consistency with the GALL Report. The staff verified that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicated 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 is consistent

with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicated 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 staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicated that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in the MNGP audit and review report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

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 LRA, the applicant stated:

> 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 staff noted that the discussion in the 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 staff 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 staff confirmed that the 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 staff 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 staff 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 staff 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, the applicant stated:

> 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 staff found the applicant's response acceptable on the basis that the components, material, aging effect and aging management program identified in the LRA are consistent with the GALL Report. The staff found that the applicant has appropriately addressed the aging management for these components. The staff's evaluation of the applicant's ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD Program is documented in Section 3.0.3.2.2 of this SER.

On the basis of its review, the staff found that the applicant addressed the aging effects/ mechanisms as identified in the GALL Report.

Conclusion. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff concluded 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 concluded 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 consistent with the CLB for the period of extended operation, as required by 10 CFR54.21(a)(3).

3.1.2.2 AMR Results that are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In LRA Section 3.1.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for the reactor coolant system components. The applicant provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to pitting and crevice corrosion
- loss of fracture toughness due to neutron irradiation embrittlement

- crack initiation and growth due to thermal and mechanical loading or stress corrosion cracking
- crack growth due to cyclic loading
- changes in dimension due to void swelling
- crack initiation and growth due to stress corrosion cracking or primary water stress corrosion cracking (PWSCC)
- crack initiation and growth due to stress corrosion cracking or irradiation-assisted stress corrosion cracking (IASCC)
- loss of preload due to stress relaxation
- loss of section thickness due to erosion
- crack initiation and growth due to PWSCC, Outside diameter Stress Corrosion Cracking (ODSCC), or intergranular attack or loss of material due to wastage and pitting corrosion or loss of section thickness due to fretting and wear or denting due to corrosion of carbon steel tube support plate
- loss of section thickness due to flow-accelerated corrosion
- ligament cracking due to corrosion
- loss of material due to flow-accelerated corrosion

Staff Evaluation. 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 staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in Section 3.1.2.2 of the SRP-LR. Details of the staff's audit are documented in the staff's MNGP audit and review report. The staff's evaluation of the aging effects is discussed in the following sections.

3.1.2.2.1 Cumulative Fatigue Damage

In LRA Section 3.1.2.2.1, the applicant stated that fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

3.1.2.2.2 Loss of Material Due to Pitting and Crevice Corrosion

The staff reviewed LRA Sections 3.1.2.2.2.1 and 3.1.2.2.2.2 against the criteria in SRP-LR Section 3.1.2.2.2.

In LRA Section 3.1.2.2.2.1, the applicant addressed steam generator shell.

Loss of material for a steam generator shell assembly is applicable to PWRs only.

In LRA Section 3.1.2.2.2.2, the applicant addressed isolation condenser.

MNGP does not have an isolation condenser.

3.1.2.2.3 Loss of Fracture Toughness Due to Neutron Irradiation Embrittlement

The staff reviewed LRA Sections 3.1.2.2.3.1 through 3.1.2.2.3.3 against the criteria in SRP-LR Section 3.1.2.2.3.

In LRA Section 3.1.2.2.3.1, the applicant addressed pressure vessel ferritic materials that have a neutron fluence greater than 10^{17} n/cm^2. The applicant stated that neutron irradiation embrittlement is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). Section 4 of this SER documents the staff's review of the applicant's evaluation of this TLAA.

In LRA Section 3.1.2.2.3.2, the applicant addressed reactor vessel embrittlement.

In LRA Section 3.1.2.2.3.2, the applicant stated 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 the evaluation of the program is documented in Subsection 3.0.3.2.21 of this SER.

In LRA Section 3.1.2.2.3.3, the applicant addressed loss of fracture toughness due to neutron irradiation embrittlement. This section is applicable to PWRs only.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.1.2.2.3. For those line items that apply to LRA Sections 3.1.2.2.3.1 through 3.1.2.2.3.3, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.2.4 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 staff reviewed 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 stated 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 stated 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 stated 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.

The staff reviewed MNGP's LRA Section 3.1.2.2.4.1, Tables 3.1.2-1 through 3.1.2-5, and LRA Appendix B2.1.23, and confirmed that small bore, Class 1 piping in the head vent system and the reactor vessel instrumentation system is appropriately included in the applicant's One-Time Inspection program.

The staff also reviewed the applicant's drawings of the reactor coolant system and connected systems, and identified a number of small-bore Class 1 pipe segments. The staff 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, the applicant provided additional information, including references to LRA table entries. The staff reviewed the applicant's response and concluded 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 stated 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 is 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 staff 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, the applicant stated 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. 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 staff reviewed the applicant's response, as documented in its letter of August 11, 2005, together with the applicant's calculation which provides the analytical basis for excluding cracking as an aging effect in Class 1, small bore carbon steel piping at MNGP. The staff noted 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 staff concluded that the applicant's programs for managing aging effects in Class 1, small bore piping are acceptable. The staff's evaluation 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 3.0.3.2.2, 3.0.3.2.19, and 3.0.3.14 of this SER, respectively.

The staff found that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.1.2.2.4.1 for further evaluation. For those line items that apply to LRA Section 3.1.2.2.4.1, the staff found 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 staff 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 LRA Section 3.1.2.2.4.2, the applicant stated 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 staff noted 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 LRA stated 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 staff found the applicant's aging management programs for these components acceptable because they are consistent with the GALL Report recommendations.

For aging management of the Reactor Vessel Flange Leak Detection Line, the applicant, in LRA Section 3.1.2.2.4.2, states that the aging effects/mechanisms for this component are 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 staff concluded that the aging management programs that the applicant has identified for this component are acceptable. **Staff reviews and evaluations of the applicant's ASME Section XI, Subsections IWB, IWC, and IWD program; the Plant Chemistry p**rogram; and the One-Time Inspection program are documented in Sections 3.0.3.2.2, 3.0.3.2.19, and 3.0.3.14 of this SER, respectively.

The staff found 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 LRA Section 3.1.2.2.4.2, the staff found 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

MNGP does not have an isolation condenser.

On the basis that MNGP does not have any components from this group, the staff concurs with the applicant's determination that this aging effect is not applicable to MNGP.

3.1.2.2.5 Crack Growth Due to Cyclic Loading

The staff reviewed LRA Section 3.1.2.2.5 against the criteria in SRP-LR Section 3.1.2.2.5.

In LRA Section 3.1.2.2.5, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.5 states that crack growth due to cyclic loading could occur in the reactor vessel shell and the reactor coolant system piping and fittings. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is only applicable to PWR plants.

The staff found that this aging effect is not applicable to MNGP.

3.1.2.2.6 Changes in Dimension Due to Void Swelling

The staff reviewed LRA Section 3.1.2.2.6 against the criteria in SRP-LR Section 3.1.2.2.6.

In LRA Section 3.1.2.2.6, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.6 states that changes in dimension due to void swelling could occur in reactor internal components. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is only applicable to PWR plants.

The staff found that this aging effect is not applicable to MNGP.

3.1.2.2.7 Crack Initiation and Growth Due to Stress Corrosion Cracking or Primary Water Stress Corrosion Cracking

The staff reviewed LRA Sections 3.1.2.2.7.1 through 3.1.2.2.7.3 against the criteria in SRP-LR Section 3.1.2.2.7.

In LRA Sections 3.1.2.2.7.1 through 3.1.2.2.7.3, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.7 states that crack initiation and growth due to SCC and PWSCC could occur: (1) in PWR core support pads (or core guide lugs), instrument tubes (bottom head penetrations), pressurizer spray heads, and nozzles for the steam generator instruments and drains; (2) in PWR CASS reactor coolant system piping and fittings and pressurizer surge line nozzles; and (3) in PWR pressurizer instrumentation penetrations and heater sheaths and sleeves made of Ni alloys. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is only applicable to PWR plants.

The staff found that this aging effect is not applicable to MNGP.

3.1.2.2.8 Crack Initiation and Growth Due to Stress Corrosion Cracking or Irradiation-Assisted Stress Corrosion Cracking

The staff reviewed LRA Section 3.1.2.2.8 against the criteria in SRP-LR Section 3.1.2.2.8.

In LRA Section 3.1.2.2.8, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.8 states that crack initiation and growth due to SCC or IASCC could occur in baffle/former bolts in Westinghouse and B&W reactors. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is only applicable to PWR plants.

The staff found that this aging effect is not applicable to MNGP.

3.1.2.2.9 Loss of Preload Due to Stress Relaxation

The staff reviewed LRA Section 3.1.2.2.9 against the criteria in SRP-LR Section 3.1.2.2.9.

In LRA Section 3.1.2.2.9, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.9 states that loss of preload due to stress relaxation could occur in baffle/former bolts in Westinghouse and B&W reactors. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is only applicable to PWR plants.

The staff found that this aging effect is not applicable to MNGP.

3.1.2.2.10 Loss of Section Thickness Due to Erosion

The staff reviewed LRA Section 3.1.2.2.10 against the criteria in SRP-LR Section 3.1.2.2.10.

In LRA Section 3.1.2.2.10, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.10 states that loss of section thickness due to erosion could occur in steam generator feedwater impingement plates and supports. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is only applicable to PWR plants.

The staff found that this aging effect is not applicable to MNGP.

3.1.2.2.11 Crack Initiation and Growth Due to PWSCC, ODSCC, or Intergranular Attack or Loss of Material Due to Wastage and Pitting Corrosion or Loss of Section Thickness Due to Fretting and Wear or Denting Due to Corrosion of Carbon Steel Tube Support Plate

The staff reviewed LRA Section 3.1.2.2.11 against the criteria in SRP-LR Section 3.1.2.2.11.

In LRA Section 3.1.2.2.11, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.11 states that crack initiation and growth due to PWSCC, ODSCC, or IGA or loss of material due to wastage and pitting corrosion or deformation due to corrosion could occur in alloy 600 components of the steam generator tubes, repair sleeves and plugs. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is only applicable to PWR plants.

The staff found that this aging effect is not applicable to MNGP.

3.1.2.2.12 Loss of Section Thickness Due to Flow-Accelerated Corrosion

The staff reviewed LRA Section 3.1.2.2.12 against the criteria in SRP-LR Section 3.1.2.2.12.

In LRA Section 3.1.2.2.12, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.12 states that loss of section thickness due to flow-accelerated corrosion could occur in tube support lattice bars made of carbon steel. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is only applicable to PWR plants.

The staff found that this aging effect is not applicable to MNGP.

3.1.2.2.13 Ligament Cracking Due to Corrosion

The staff reviewed LRA Section 3.1.2.2.13 against the criteria in SRP-LR Section 3.1.2.2.13.

In LRA Section 3.1.2.2.13, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.13 states that ligament cracking due to corrosion could occur in carbon steel components in the steam generator tube support plate. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is only applicable to PWR plants.

The staff found that this aging effect is not applicable to MNGP.

3.1.2.2.14 Loss of Material Due to Flow-Accelerated Corrosion

The staff reviewed LRA Section 3.1.2.2.14 against the criteria in SRP-LR Section 3.1.2.2.14.

In LRA Section 3.1.2.2.14, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.1.2.2.14 states that loss of material due to flow-accelerated corrosion could occur in feedwater inlet ring and supports. SRP-LR Table 3.1-1 states that further evaluation for this aging effect is only applicable to PWR plants.

The staff found that this aging effect is not applicable to MNGP.

Conclusion. On the basis of its 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 staff determines that the applicant adequately addressed the issues that were further evaluated. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3 AMR Results that are Not Consistent With or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In LRA Tables 3.1.2-1 through 3.1.2-5, the staff 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 that are not addressed in the GALL Report.

In LRA Tables 3.1.2-1 through 3.1.2-5, the applicant indicated, via Notes F through J, that the combination of component type, material, environment, and aging effect requiring management does not correspond to a line item in the GALL Report, and provided information concerning how the aging effect will be managed. Specifically, Note F indicated that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicated that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicated that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicated that the aging effect identified in the GALL Report for the line item component, material, and environment

combination is not applicable. Note J indicated that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

Staff Evaluation. For component type, material, and environment combinations that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation. AMR results where no aging effects were identified in LRA Tables 3.1.2-1 through 3.1.2-5 are addressed in Section 3.1.2.3.1 of this SER. Other line items that are not consistent with the GALL Report or not addressed in the GALL Report are addressed separately within each Table write-up. The staff's evaluation is discussed in the following sections.

3.1.2.3.1 Aging Management Review Results Where No Aging Effects Were Identified (LRA Tables 3.1.2-1 through 3.1.2-5)

In 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 stated 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 stated 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 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 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 staff found 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 staff concluded that there are no applicable aging effects requiring management for the component material and environment described in the preceding discussion.

3.1.2.3.2 Reactor Coolant System – Reactor Head Vent System – Summary of Aging Management Evaluation – Table 3.1.2-1

The staff reviewed LRA Table 3.1.2-1, which summarizes the results of AMR evaluations for the reactor head vent system component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.1.2.3.1, above.

3.1.2.3.3 Reactor Coolant System – Reactor Pressure Vessel – Summary of Aging Management Evaluation – Table 3.1.2-2

The staff reviewed LRA Table 3.1.2-2, which summarizes the results of AMR evaluations for the reactor pressure vessel component groups.

In LRA Table 3.1.2-2, the applicant stated 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 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 LRA states that the CRD hydraulic return nozzle was capped with a 4-inch 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 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 staff 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; it is not based on 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. On the basis 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 staff found 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.

The applicant proposed to manage **<INSERT Information Provided by Tech Staff (EMCB-A/Elliot)>**

On the basis of its audit and review of the applicant's program, the staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended

functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.2.3.4 Reactor Coolant System – Reactor Pressure Vessel Internals – Summary of Aging Management Evaluation – Table 3.1.2-3

The staff reviewed LRA Table 3.1.2-3, which summarizes the results of AMR evaluations for the reactor pressure vessel internals component groups.

In LRA Table 3.1.2-3, the applicant proposed 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 staff reviewed MNGP's BWR Vessel Internals Program and its evaluation is documented in Section 3.0.3.2.11 of this SER. 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.

LRA Table 3.1.2-3 identified 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 LRA, stated 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 staff concluded 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 staff found 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 staff found 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 staff determined 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).

3.1.2.3.5 Reactor Coolant System – Reactor Recirculation System – Summary of Aging Management Evaluation – Table 3.1.2-4

The staff reviewed LRA Table 3.1.2-4, which summarizes the results of AMR evaluations for the reactor recirculation system component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.1.2.3.1, above.

3.1.2.3.6 Reactor Coolant System – Reactor Vessel Instrumentation – Summary of Aging Management Evaluation – Table 3.1.2-5

The staff reviewed LRA Table 3.1.2-5, which summarizes the results of AMR evaluations for the reactor vessel instrumentation component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.1.2.3.1, above.

Conclusion. On the basis of its review, the staff found that the applicant appropriately evaluated AMR results involving material, environment, aging effects requiring management, and AMP combinations that are not evaluated in the GALL Report. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.1.3 Conclusion

The staff concluded that the applicant provided sufficient information to demonstrate that the effects of aging for the reactor coolant system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the reactor coolant system, as required by 10 CFR 54.21(d).

3.2 Aging Management of Engineered Safety Features

This section of the SER documents the staff's review of the applicant's aging management review (AMR) results for the engineered safety features (ESF) components and component groups associated with the following systems:

- automatic pressure relief system
- combustible gas control system
- core spray system
- high-pressure coolant injection system
- primary containment mechanical system
- reactor core isolation cooling system
- residual heat removal system
- secondary containment system

3.2.1 Summary of Technical Information in the Application

In LRA Section 3.2, the applicant provided AMR results for the ESF components and component groups. In LRA Table 3.2.1, “Summary of Aging Management Evaluations in Chapter V of NUREG-1801 for Engineered Safety Features,” the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the ESF components and component groups.

The applicant’s AMRs incorporated applicable operating experience in the determination of aging effects requiring management (AERMs). These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant’s review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.2.2 Staff Evaluation

The staff reviewed LRA Section 3.2 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the ESF components that are within the scope of license renewal and subject to an AMR 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).

Also, the staff performed an onsite audit of AMRs to confirm the applicant’s claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMRs. The staff’s evaluations of the AMPs are documented in Section 3.0.3 of this SER. Details of the staff’s audit evaluation are documented in the MNGP audit and review report and are summarized in Section 3.2.2.1 of this SER.

The staff also performed an onsite audit of those selected AMRs that were consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant’s further evaluations were consistent with the acceptance criteria in Section 3.2.2.2 of the SRP-LR. The staff’s audit evaluations are documented in the MNGP audit and review report and are summarized in Section 3.2.2.2 of this SER.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that were not consistent with, or not addressed in, the GALL Report. The audit and technical review included evaluating whether all plausible aging effects were identified and evaluating whether the aging effects listed were appropriate for the combination of materials and environments specified. The staff’s audit evaluations are documented in the MNGP audit and review report and are summarized in Section 3.2.2.3 of this SER. The staff’s evaluation of its technical review is also documented in Section 3.2.2.3 of this SER.

Finally, the staff reviewed the AMP summary descriptions in the USAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the ESF components.

Table 3.2-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.2, that are addressed in the GALL Report.

Table 3.2-1 Staff Evaluation for Engineered Safety Features Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff 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(c)	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	One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL, 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 systems (Item Number 3.2.1-03)	Loss of material due to general corrosion	Plant specific	One-Time Inspection Program (B2.1.23), System Condition Monitoring Program (B2.1.32)	Consistent with GALL, which recommends further evaluation (See Section 3.2.2.2.2.2)
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	One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL, which recommends further evaluation (See Section 3.2.2.2.3.1)
Components in containment spray (PWR only), standby gas treatment (BWR only), containment isolation, and emergency core cooling systems (Item Number 3.2.1-05)	Loss of material due to pitting and crevice corrosion	Plant specific	One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL, which recommends further evaluation (See Section 3.2.2.2.3.2)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Containment isolation valves and associated piping (Item Number 3.2.1-06)	Loss of material due to microbiologically influenced corrosion	Plant specific	One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL, which recommends further evaluation 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 Program (B2.1.23), System Condition Monitoring Program (B2.1.32)	Consistent with GALL, which recommends further evaluation (See Section 3.2.2.2.5)
High pressure safety injection (charging) pump miniflow orifice (Item Number 3.2.1-08)	Loss of material due to erosion	Plant specific		Not applicable, PWR only
Drywell and suppression chamber spray system nozzles and flow orifices (Item Number 3.2.1-09)	Plugging of nozzles and flow orifices due to general corrosion	Plant specific		Not applicable (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	One-Time Inspection Program (B2.1.23), System Condition Monitoring Program (B2.1.32)	Consistent with GALL, which recommends further evaluation (See Section 3.2.2.3.2)
Piping and fittings of CASS in emergency core cooling system (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.
Components serviced by open-cycle cooling system (Item Number 3.2.1-12)	Local loss of material due to corrosion and/or buildup of deposit due to biofouling	Open-cycle cooling water system	One-Time Inspection Program (B2.1.23), Open-Cycle Cooling Water System Program (B2.1.24), Plant Chemistry Program (B2.1.25)	Consistent with GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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
Emergency core cooling system valves and lines to and from HPCI and RCIC pump turbines (Item Number 3.2.1-14)	Wall thinning due to flow-accelerated corrosion	Flow-accelerated corrosion		This line item is not used at MNGP (See Section 3.2.2.1.1)
Pumps, valves, piping, and fittings in containment spray and emergency core cooling systems (Item Number 3.2.1-15)	Crack initiation and growth due to SCC	Water chemistry		Not applicable, PWR only
Pumps, valves, piping, and fittings in emergency core cooling systems (Item Number 3.2.1-16)	Crack initiation and growth due to SCC and IGSCC	Water chemistry and BWR stress corrosion cracking	BWR Stress Corrosion Cracking Program (B2.1.10), One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL Report
Carbon steel components (Item Number 3.2.1-17)	Loss of material due to boric acid corrosion	Boric acid corrosion		Not applicable, PWR only
Closure bolting in high pressure or high temperature systems (Item Number 3.2.1-18)	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	Bolting integrity	Bolting Integrity Program (B2.1.4)	Consistent with GALL Report

The staff's review of the MNGP component groups followed one of several approaches. One approach, documented in Section 3.2.2.1, involves the staff's review of the AMR results for components in the ESF systems that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.2.2.2, involves the staff's review of the AMR results for components in the ESF systems that the applicant indicated are consistent with the GALL Report and for which further

evaluation is recommended. A third approach, documented in Section 3.2.2.3, involves the staff's review of the AMR results for components in the ESF systems that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs that are credited to manage or monitor aging effects of the ESF systems components is documented in Section 3.0.3 of this SER.

3.2.2.1 AMR Results that are Consistent with the GALL Report

Summary of Technical Information in the Application. In LRA Section 3.2.2.1, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the ESF components:

- ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program (B2.1.2)
- Bolting Integrity Program (B2.1.4)
- Buried Piping & Tanks Inspection Program (B2.1.5)
- BWR Stress Corrosion Cracking Program (B2.1.10)
- Closed-Cycle Cooling Water System Program (B2.1.13)
- Flow-Accelerated Corrosion Program (B2.1.19)
- One-Time Inspection Program (B2.1.23)
- Open-Cycle Cooling Water System Program (B2.1.24)
- Plant Chemistry Program (B2.1.25)
- Selective Leaching of Materials Program (B2.1.30)
- System Condition Monitoring Program (B2.1.32)

Staff Evaluation. In LRA Tables 3.2.2-1 through 3.2.2-8, the applicant provided a summary of AMRs for the ESF components, and identified which AMRs it considered to be consistent with the GALL Report.

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 does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those

AMRs with Notes A through E, which indicated that the AMR was consistent with the GALL Report.

Note A indicated 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. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicated 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 staff audited these line items to verify consistency with the GALL Report. The staff verified that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicated 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 is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicated 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 staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicated that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in the MNGP audit and review report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

3.2.2.1.1 Wall Thinning due to Flow-Accelerated Corrosion (FAC)

In the discussion section of LRA Table 3.2.1, Item Number 3.2.1-14, the applicant stated 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 staff noted that Table 3.2.1, Item Number 3.2.1-14 was not used for Table 2 data. The staff 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 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 staff asked the applicant as to the reason for crediting another line item number for this aging effect. The applicant responded 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, the applicant revised the 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 staff found 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 staff evaluation of the FAC Program is documented in Section 3.0.3.12 of this SER.

On the basis of its review, the staff found that the applicant addressed the aging effect/mechanism as identified in the GALL Report.

Conclusion. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff concluded 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 concluded 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 consistent with the CLB for the period of extended operation, as required by 10 CFR54.21(a)(3).

3.2.2.2 AMR Results that are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In LRA Section 3.2.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for the ESF components. The applicant provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general corrosion
- local loss of material due to pitting and crevice corrosion
- local loss of material due to microbiologically influenced corrosion
- changes in properties due to elastomer degradation
- local loss of material due to erosion
- buildup of deposits due to corrosion

Staff Evaluation. 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 staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in Section 3.2.2.2 of the SRP-LR. Details of the staff's audit are documented in the staff's MNGP audit and review report. The staff's evaluation of the aging effects is discussed in the following sections.

3.2.2.2.1 Cumulative Fatigue Damage

In LRA Section 3.2.2.2.1, the applicant stated that fatigue is a TLAA, as defined in 10 CFR Part 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

3.2.2.2.2 Loss of Material Due to General Corrosion

3.2.2.2.2.1 Areas with Stagnant Flow Conditions

The staff 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 LRA Section 3.2.2.2.2.1, the applicant stated 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 AMP B2.1.23, One-Time Inspection program, or the combination of the One-Time Inspection program and AMP B2.1.25, Plant Chemistry program. The applicant stated 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.

The staff's evaluation of the One-Time Inspection program and the Plant Chemistry program is documented in Sections 3.0.3.1.4 and 3.0.3.2.19 of this SER, respectively.

The applicant, in the 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 staff found these items to be properly managed during the period of extended operation. In addition, there are some aging mechanisms covered in the LRA, Section 3.2.2.2.2, managed 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. The applicant responded that these mechanisms could cause the aging effect, loss of material and that this was a conservative approach. The staff concluded that the applicant was taking a conservative approach to aging management and that it was consistent with the GALL Report.

Based on the technical information provided in the LRA Section 3.2 and review of the LRA One-Time Inspection Program and Plant Chemistry Program, the staff found that the applicant has 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.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.2.2.2.2.1. For those line items that apply to LRA Section 3.2.2.2.2.1, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.2.2 Interior and Exterior Surfaces of Carbon Steel Components

The staff 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 LRA Section 3.2.2.2.2.2, the applicant stated 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 stated, in the 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 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 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 staff and found 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 3.0.3.1.4 of this SER.

The staff 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 staff 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 staff'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 evaluation of the System Conditioning Monitoring Program is documented in Section 3.0.3.3.2 of this SER.

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 staff 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.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.2.2.2.2.2. For those line items that apply to LRA Section 3.2.2.2.2.2, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.3 Local Loss of Material Due to Pitting and Crevice Corrosion

3.2.2.2.3.1 Areas with Stagnant Flow Conditions

The staff 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 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.

As documented in the audit and review report, 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 staff 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 staff concluded, 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 staff and the evaluation of these programs is documented in Sections 3.0.3.1.4 and 3.0.3.2.19 of this SER, respectively.

The staff 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. This aging effect/mechanisms are managed by the One-Time Inspection program and/or Plant Chemistry program.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.2.2.2.3.1. For those line items that apply to LRA Section 3.2.2.2.3.1, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.3.2 Interior and Exterior Surfaces of Carbon and Stainless Steel Components

The staff 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 LRA Section 3.2.2.2.3.2, the applicant addressed 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 proposed 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 staff 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 staff 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 staff's evaluation of the Plant Chemistry program and One-Time Inspection program are documented in Sections 3.0.3.2.19 and 3.0.3.1.4 of this SER, respectively.

The staff 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 staff 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 staff 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. This aging effect/mechanisms are managed by the One-Time Inspection program and Plant Chemistry program.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.2.2.2.3.2. For those line items that apply to LRA Section 3.2.2.2.3.2, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.4 Local Loss of Material Due to Microbiologically Influenced Corrosion

The staff 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 addressed 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 staff 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 3.0.3.2.19 and 3.0.3.1.4 of this SER, respectively.

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 LRA, the staff's review and audit found that the applicants aging management programs are acceptable for management of loss of material due to MIC for the containment isolation valves and associated piping.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.2.2.2.4. For those line items that apply to LRA Section 3.2.2.2.4, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.5 Changes in Properties Due to Elastomer Degradation

The staff 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 addressed 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 staff 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 3.0.3.1.4 of this SER.

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 staff reviewed the System Condition Monitoring program and found it to be acceptable and consistent with the GALL Report for managing this aging effect/mechanism. The System Condition Monitoring program is documented in Section3.0.3.3.2 of this SER.

The staff reviewed and determined that the applicant's use of the 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 staff 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 staff 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.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.2.2.2.5. For those line items that apply to LRA Section 3.2.2.2.5, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.2.6 Local Loss of Material Due to Erosion

The staff reviewed LRA Section 3.2.2.2.6 against the criteria in SRP-LR Section 3.2.2.2.6.

In LRA Section 3.2.2.2.6, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.2.2.2.6 states that local loss of material due to erosion could occur in the high pressure safety injection pump miniflow orifice. SRP-LR Table 3.2-1 states that further evaluation for this aging effect is only applicable to PWR plants.

The staff found that this aging effect is not applicable to MNGP.

3.2.2.2.7 Buildup of Deposits Due to Corrosion

The staff 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 addressed 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 staff 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 staff 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, On the basis 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 staff found 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 staff concluded 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 review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.2.2.2.7. For those line items that apply to LRA Section 3.2.2.2.7, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determines that the applicant adequately addressed the issues that were further evaluated. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.2.3 AMR Results that are Not Consistent With or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In LRA Tables 3.2.2-1 through 3.2.2-8, the staff 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 that are not addressed in the GALL Report.

In LRA Tables 3.2.2-1 through 3.2.2-8, the applicant indicated, via Notes F through J, that the combination of component type, material, environment, and aging effect requiring management does not correspond to a line item in the GALL Report, and provided information concerning how the aging effect will be managed. Specifically, Note F indicated that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicated that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicated that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicated that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicated that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

Staff Evaluation. For component type, material, and environment combinations that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation. The staff's evaluation is discussed in the following sections.

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 LRA Tables 3.2.2-1 through 3.2.2-8, the staff 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 stated that no aging effects occur when ESF system components fabricated from:

- Copper
- Carbon steel
- Nickel alloy
- Stainless steel material
- CASS
- 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.)
- Outdoor air protected

The applicant stated 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. Specifically, the applicant stated 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 stated 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 staff reviewed this technical information against the LRA Tables 3.2.2-1 through 3.2.2-8, 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 to perform their intended function during the period of extended operation. This conclusion is based on industry and plant operating experience of these components in these environments.

As cited in *Metals Handbook*, Ninth Edition, Volume 13, American Society for Metals International, stainless steels are highly resistant to corrosion in dry atmospheres in the absence of corrosive species, therefore, 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 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 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 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 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 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 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 LRA Section 3.2.1, indicates that the GALL Report does not show this material for this component as subject to aging management.

The staff 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 staff 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 its review of current industry research and operating experience, the staff found 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 staff concluded that there are no applicable aging effects requiring management for the component material and environment described in the preceding discussion.

3.2.2.3.2 Engineered Safety Features – Automatic Pressure Relief System – Summary of Aging Management Evaluation – Table 3.2.2-1

The staff reviewed LRA Table 3.2.2-1, which summarizes the results of AMR evaluations for the automatic pressure relief system component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.2.2.3.1, above.

3.2.2.3.3 Engineered Safety Features – Combustible Gas Control System – Summary of Aging Management Evaluation – Table 3.2.2-2

The staff reviewed LRA Table 3.2.2-2, which summarizes the results of AMR evaluations for the combustible gas control system component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.2.2.3.1, above.

3.2.2.3.4 Engineered Safety Features – Core Spray System – Summary of Aging Management Evaluation – Table 3.2.2-3

The staff reviewed LRA Table 3.2.2-3, which summarizes the results of AMR evaluations for the core spray system component groups.

In LRA Table 3.2.2-3, the applicant proposed to manage loss of material due to crevice corrosion, MIC and pitting corrosion of copper alloys for ESF heat exchangers exposed to raw water environment using MNGP AMP B2.1.23, "Open Cycle Cooling Water."

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 staff reviewed the Open-Cycle Cooling Water System and found it to be acceptable and consistent with the GALL Report. The evaluation of the Open-Cycle Cooling Water System program is documented in Section 3.0.3.1.5 of this SER. The staff has determined that this AMP is adequate for managing this material/environment/aging effect.

In LRA Table 3.2.2-3, the applicant proposed to manage loss of material due to selective leaching of copper alloys for ESF heat exchangers in a raw water environment using MNGP AMP B2.1.30, "Selective Leaching of Materials."

The staff reviewed the applicant's Selective Leaching of Materials program, and its evaluation is documented in Section 3.0.3.2.22 of this SER. 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 determined that this AMP is adequate for managing this material/environment/aging effect.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that the aging effect of loss of material due to crevice corrosion, MIC and pitting corrosion of copper alloys for ESF heat exchangers exposed to raw water environment in LRA Table 3.2.2.-3 are effectively managed using the Open Cycle Cooling Water program, and the Selective Leaching of Materials program.

3.2.2.3.5 Engineered Safety Features – High Pressure Coolant Injection System – Summary of Aging Management Evaluation – Table 3.2.2-4

The staff reviewed LRA Table 3.2.2-4, which summarizes the results of AMR evaluations for the high pressure coolant injection system component groups.

In LRA Table 3.2.2-4, the applicant proposed to manage heat transfer degradation and fouling of heat exchangers fabricated from copper alloy in lubricating oil (ext.)/treated water (int.) with the MNGP AMP B2.1.23 “One-Time Inspection Program,” and in steam (ext.)/treated water (int.) environments using MNGP AMP B2.1.25 “Plant Chemistry Program,” combined with MNGP AMP B2.1.23 “One-Time Inspection Program.” The applicant also proposed to manage the loss of material due to crevice corrosion and pitting corrosion of heat exchangers fabricated from copper alloy in a steam (ext.)/treated water (int.) environments and MIC in treated water (int.) using MNGP AMP B2.1.25 “Plant Chemistry Program,” combined with MNGP AMP B2.1.23 “One-Time Inspection Program.”

The staff reviewed the applicant’s Plant Chemistry program and the One-Time Inspection program, and its evaluation of each is documented in Sections 3.0.3.2.19 and 3.0.3.1.4 of this SER, 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 Plant 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. MNGP has chosen a different combination of AMPs to manage the AERM. The staff determined that this combination is adequate for managing this material/environment/aging effect and found it to be acceptable.

In LRA Table 3.2.2-4, the applicant proposed to manage the loss of material due to selective leaching of heat exchangers fabricated from copper alloy in a steam (ext.)/treated water (int.) environment using MNGP AMP B2.1.30, “Selective Leaching of Materials.”

The staff reviewed the applicant’s Selective Leaching of Materials program, and its evaluation is documented in Section 3.0.3.2.22 of this SER. 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 determined that this program is adequate for managing this material/environment/aging effect and found it to be acceptable.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Rajan)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Rajan)>

3.2.2.3.6 Engineered Safety Features – Primary Containment Mechanical System – Summary of Aging Management Evaluation – Table 3.2.2-5

The staff reviewed LRA Table 3.2.2-5, which summarizes the results of AMR evaluations for the primary containment mechanical system component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.2.2.3.1, above.

3.2.2.3.7 Engineered Safety Features – Reactor Core Isolation Cooling System – Summary of Aging Management Evaluation – Table 3.2.2-6

The staff reviewed LRA Table 3.2.2-6, which summarizes the results of AMR evaluations for the reactor core isolation cooling system component groups.

In LRA Table 3.2.2-6, the applicant proposed to manage heat transfer degradation and fouling of heat exchangers fabricated from copper alloy in lubricating oil (ext.) with the MNGP AMP B2.1.23 "One-Time Inspection Program," and in treated water (int.) environment using MNGP AMP B2.1.25 "Plant Chemistry Program," combined with MNGP AMP B2.1.23 "One-Time Inspection Program." The applicant also proposed to manage the loss of material due to crevice corrosion, MIC and pitting corrosion of heat exchangers fabricated from copper alloy in a treated water (int.) environment using MNGP AMP B2.1.25 "Plant Chemistry Program," combined with MNGP AMP B2.1.23 "One-Time Inspection Program."

The staff reviewed the applicant's Plant Chemistry program and the One-Time Inspection program, and its evaluation of each is documented in Sections 3.0.3.2.19 and 3.0.3.1.4 of this SER, 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 Plant 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. MNGP has chosen a different combination of AMPs to manage the AERM. The staff determined that this combination is adequate for managing this material/environment/aging effect and found it to be acceptable.

In LRA Table 3.2.2-6, the applicant proposed to manage the loss of material due to selective leaching of heat exchangers fabricated from copper alloy in a treated water (int.) environment using MNGP AMP B2.1.30, "Selective Leaching of Materials."

The staff reviewed the applicant's Selective Leaching of Materials program, and its evaluation is documented in Section 3.0.3.2.22 of this SER. 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 determined that this program is adequate for managing this material/environment/aging effect and found it to be acceptable.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Rajan)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Rajan)>

3.2.2.3.8 Engineered Safety Features – Residual Heat Removal System – Summary of Aging Management Evaluation – Table 3.2.2-7

The staff reviewed LRA Table 3.2.2-7, which summarizes the results of AMR evaluations for the residual heat removal system component groups.

In LRA Table 3.2.2-7, the applicant proposed to manage heat transfer degradation and fouling of heat exchangers fabricated from copper alloy in lubricating oil (ext.) with the MNGP AMP B2.1.23 "One-Time Inspection Program," and in raw water (int.) environment using MNGP AMP B2.1.23, "Open Cycle Cooling Water." The applicant also proposed to manage the loss of material due to crevice corrosion, MIC and pitting corrosion of heat exchangers fabricated from copper alloy in a raw water (int.) environment using MNGP AMP B2.1.23, "Open Cycle Cooling Water."

The staff reviewed the applicant's One-Time Inspection program, and its evaluation of each is documented in Section 3.0.3.1.4 of this SER. 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 Plant 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 determined that this program is adequate for managing this material/environment/aging effect and found it to be acceptable.

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 staff reviewed the Open-Cycle Cooling Water System and found it to be acceptable and consistent with the GALL Report. The evaluation of the Open-Cycle Cooling Water System program is documented in Section 3.0.3.1.5 of this SER. The staff has determined that this AMP is adequate for managing this material/environment/aging effect.

In LRA Table 3.2.2-7, the applicant proposed to manage the loss of material due to MIC, crevice corrosion, and pitting corrosion of RHR nozzles fabricated from copper alloy in a treated water (int.) environment using MNGP AMP B2.1.25 "Plant Chemistry Program," combined with MNGP AMP B2.1.23 "One-Time Inspection Program."

The staff reviewed the applicant's Plant Chemistry program and the One-Time Inspection program, and its evaluation of each is documented in Sections 3.0.3.2.19 and 3.0.3.1.4 of this SER, 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 Plant 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. MNGP has chosen a different combination of AMPs to manage the AERM. The staff determined that this combination is adequate for managing this material/environment/aging effect and found it to be acceptable.

In LRA Table 3.2.2-7, the applicant proposed to manage the loss of material due to selective leaching of heat exchangers fabricated from copper alloy in a raw water (int.) environment, and RHR nozzles fabricated from copper alloy in a treated water (int.) environment using MNGP AMP B2.1.30, "Selective Leaching of Materials."

The staff reviewed the applicant's Selective Leaching of Materials program, and its evaluation is documented in Section 3.0.3.2.22 of this SER. 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 determined that this AMP is adequate for managing this material/environment/aging effect.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Rajan)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Rajan)>

3.2.2.3.9 Engineered Safety Features – Secondary Containment System – Summary of Aging Management Evaluation – Table 3.2.2-8

The staff reviewed LRA Table 3.2.2-8, which summarizes the results of AMR evaluations for the secondary containment system component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.2.2.3.1, above.

Conclusion. On the basis of its review, the staff found that the applicant appropriately evaluated AMR results involving material, environment, aging effects requiring management, and AMP combinations that are not evaluated in the GALL Report. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.2.3 Conclusion

The staff concluded that the applicant provided sufficient information to demonstrate that the effects of aging for the ESF components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the ESF, as required by 10 CFR 54.21(d).

3.3 Aging Management of Auxiliary Systems

This section of the SER documents the staff's review of the applicant's aging management review (AMR) results for the auxiliary systems components and component groups associated with the following systems:

- alternate nitrogen system
- chemistry sampling system
- circulating water system
- control rod drive system
- demineralized water system
- emergency diesel generators system
- emergency filtration train system
- emergency service water system
- fire system
- fuel pool cooling and cleanup system
- heating and ventilation system
- instrument and service air system
- radwaste solid and liquid system
- reactor building closed cooling water system
- reactor water cleanup system
- service and seal water system
- standby liquid control system
- wells and domestic water system

3.3.1 Summary of Technical Information in the Application

In LRA Section 3.3, the applicant provided AMR results for the auxiliary systems components and component groups. In LRA Table 3.3.1, “Summary of Aging Management Evaluations in Chapter VII of NUREG-1801 for Auxiliary Systems,” the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the auxiliary systems components and component groups.

The applicant’s AMRs incorporated applicable operating experience in the determination of aging effects requiring management (AERMs). These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant’s review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.3.2 Staff Evaluation

The staff reviewed LRA Section 3.3 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the auxiliary systems components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Also, the staff performed an onsite audit of AMRs to confirm the applicant’s claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMRs. The staff’s evaluations of the AMPs are documented in Section 3.0.3 of this SER. Details of the staff’s audit evaluation are documented in the MNGP audit and review report and are summarized in Section 3.3.2.1 of this SER.

The staff also performed an onsite audit of those selected AMRs that were consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant’s further evaluations were consistent with the acceptance criteria in Section 3.3.2.2 of the SRP-LR. The staff’s audit evaluations are documented in the MNGP audit and review report and are summarized in Section 3.3.2.2 of this SER.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that were not consistent with, or not addressed in, the GALL Report. The audit and technical review included evaluating whether all plausible aging effects were identified and evaluating whether the aging effects listed were appropriate for the combination of materials and environments specified. The staff’s audit evaluations are documented in the MNGP audit and review report and are summarized in Section 3.3.2.3 of this SER. The staff’s evaluation of its technical review is also documented in Section 3.3.2.3 of this SER.

Finally, the staff reviewed the AMP summary descriptions in the USAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the auxiliary systems components.

Table 3.3-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.3, that are addressed in the GALL Report.

Table 3.3-1 Staff Evaluation for Auxiliary Systems Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff 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	Compressed Air Monitoring Program (B2.1.14), One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL, which recommends further evaluation (See Sections 3.3.2.2.1.1 and 3.3.2.2.1.2)
Linings in spent fuel pool 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 54.21(c)	TLAA	This TLAA is evaluated in Section 4.3, Metal Fatigue of the RPV and Internals, and Reactor Coolant Pressure Boundary Piping and Components and Section 4.9, Reactor Building Crane Load Cycles
Heat exchangers in reactor water cleanup system (BWR); high pressure pumps in chemical and volume control system (PWR) (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)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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 Protection Program (B2.1.17), Fire Water System Program (B2.1.18), One-Time Inspection Program (B2.1.23), System Condition Monitoring Program (B2.1.32)	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.5)
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 of material due to general, pitting, and crevice corrosion, MIC, and biofouling	Fuel oil chemistry and one-time inspection	Fuel Oil Chemistry Program (B2.1.20), One-Time Inspection Program (B2.1.23)	Consistent with GALL, 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	Compressed Air Monitoring Program (B2.1.14), One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL, which recommends further evaluation (See Section 3.3.2.2.1.2)
Heat exchangers in chemical and volume control system (Item Number 3.3.1-09)	Crack initiation and growth due to SCC and cyclic loading	Water chemistry and a plant-specific verification program		Not applicable, PWR only
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	One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL, which recommends further evaluation (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	None	Not applicable

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Neutron absorbing sheets in spent fuel storage racks (Item Number 3.3.1-12)	Reduction of neutron absorbing capacity due to Boraflex degradation	Boraflex monitoring		Not applicable. Boarflex is not used at MNGP.
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)	Consistent with GALL Report
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. Loss of material due to boric acid corrosion is not applicable since MNGP is a BWR type facility that does not utilize boric acid.
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 Program (B2.1.23)	Consistent with GALL Report
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 and Light Load (Related to Refueling) Handling Systems Program (B2.1.22)	Consistent with GALL Report
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	One-Time Inspection Program (B2.1.23), Open-Cycle Cooling Water System Program (B2.1.24)	Consistent with GALL Report
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 tanks surveillance or Buried piping and tanks inspection	Bolting Integrity Program (B2.1.4), Buried Piping & Tanks Inspection Program (B2.1.5)	Consistent with GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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 Program (B2.1.14)	Consistent with GALL Report
Components (doors and barrier penetration seals) and 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
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 3.3.2.1.1)
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	Fire Protection Program (B2.1.17), Fuel Oil Chemistry Program (B2.1.20), One-Time Inspection Program (B2.1.23)	Consistent with GALL Report
Tanks in diesel fuel oil system (Item Number 3.3.1-23)	Loss of material due to general, pitting, and crevice corrosion	Aboveground carbon steel tanks		Not applicable. MNGP does not have any above ground carbon steel tanks exposed to outdoor ambient conditions within the scope of License Renewal.
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 Program (B2.1.4)	Consistent with GALL Report
Components in contact with sodium pentaborate solution in standby liquid control system (BWR) (Item Number 3.3.1-25)	Crack initiation and growth due to SCC	Water chemistry		Not applicable. At MNGP, the components exposed to sodium pentaborate solution are in an environment such that the components are not susceptible to SCC.

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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	One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL Report
Components in shutdown cooling system (older BWR) (Item Number 3.3.1-27)	Crack initiation and growth due to SCC	BWR stress corrosion cracking and water chemistry	BWR Stress Corrosion Cracking Program (B2.1.10), Closed-Cycle Cooling Water System Program (B2.1.13), One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL Report
Components in shutdown cooling system (older BWR) (Item Number 3.3.1-28)	Loss of material due to pitting and crevice corrosion, and MIC	Closed-cycle cooling water system		Not applicable.
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 Program (B2.1.30)	Consistent with GALL report
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

The staff's review of the MNGP component groups followed one of several approaches. One approach, documented in Section 3.3.2.1, involves the staff's review of the AMR results for components in the auxiliary systems that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.3.2.2, involves the staff's review of the AMR results for components in the auxiliary systems that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.3.2.3, involves the staff's review of the AMR results for components in the auxiliary systems that the applicant

indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs that are credited to manage or monitor aging effects of the auxiliary systems components is documented in Section 3.0.3 of this SER.

3.3.2.1 AMR Results that are Consistent with the GALL Report

Summary of Technical Information in the Application. In LRA Section 3.3.2.1, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the auxiliary systems components:

- Bolting Integrity Program (B2.1.4)
- Buried Piping & Tanks Inspection Program (B2.1.5)
- BWR Stress Corrosion Cracking Program (B2.1.10)
- Closed-Cycle Cooling Water System Program (B2.1.13)
- Compressed Air Monitoring Program (B2.1.14)
- Fire Protection Program (B2.1.17)
- Fire Water System Program (B2.1.18)
- Flow-Accelerated Corrosion Program (B2.1.19)
- Fuel Oil Chemistry Program (B2.1.20)
- One-Time Inspection Program (B2.1.23)
- Open-Cycle Cooling Water System Program (B2.1.24)
- Plant Chemistry Program (B2.1.25)
- Selective Leaching of Materials Program (B2.1.30)
- System Condition Monitoring Program (B2.1.32)

Staff Evaluation. In LRA Tables 3.3.2-1 through 3.3.2-18, the applicant provided a summary of AMRs for the auxiliary systems components and identified which AMRs it considered to be consistent with the GALL Report.

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 does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated that the AMR was consistent with the GALL Report.

Note A indicated 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. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicated 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 staff audited these line items to verify consistency with the GALL Report. The staff verified that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicated 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 is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicated 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 staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicated that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in the MNGP audit and review report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

3.3.2.1.1 Loss of Material for Components in Water-Based Fire Protection

In the discussion section of Table 3.3.1, Item Number 3.3.1-21 of the LRA, the applicant stated that:

> Loss of material due to general, pitting, crevice, galvanic corrosion, and MIC as well heat transfer degradation due to fouling for components in the fire system are managed by the Fire Protection and Fire Water System programs. The Fire Water System program is applied for the majority of the components in the fire system. The Fire Protection program is applied to those components in the fire system associated with the diesel fire pump with the exception of the diesel fire

pump diesel engine fuel oil supply. In addition, the Fire Protection program is applied to non-water-based fire protection subsystems such as Halon. Exceptions apply to NUREG-1801 recommendations for Fire Protection program implementation. Implementation of the Fire Water System and Fire Protection 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.

In LRA Table 3.3.2-9 for fire systems, the applicant has credited the MNGP B2.1.17 Fire Protection program to manage loss of material due to general, pitting, crevice, and galvanic corrosion and MIC for copper alloy and gray cast iron material in a raw water environment. GALL Report item VII.G6-b is referenced, which evaluates filter, fire hydrant, mulsifier, pump casing, sprinkler, strainer, and valve bodies from a variety of materials including cast iron, bronze and copper. The GALL Report also recommends the Fire Water System program for managing this aging effect. The applicant has referenced footnote E, which indicates a different aging management program, Fire Protection program is used. As stated above, the applicant in the discussion section of Table 3.3-1, item 3.3.1-21 indicates that the Fire Protection program is applied to non-water based fire protection systems. This is in conflict with the Table 3.3.2-9 line items. Furthermore, the LRA does not identify in the program write-up how the Fire Protection program will manage this aging effect in water-based systems.

The staff issued RAI 3.3.2.9-1 requesting that the applicant clarify how the Fire Protection program will manage loss of material due to general, pitting, crevice, and galvanic corrosion in water-based fire protection systems.

In response to the RAI, the applicant stated...

Conclusion. The staff evaluated the applicant’s claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant’s consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff concluded 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 concluded 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 consistent with the CLB for the period of extended operation, as required by 10 CFR54.21(a)(3).

3.3.2.2 AMR Results that are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In LRA Section 3.3.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for the auxiliary systems components. The applicant provided information concerning how it will manage the following aging effects:

- loss of material due to general, pitting, and crevice corrosion
- hardening and cracking or loss of strength due to elastomer degradation or loss of material due to wear

- cumulative fatigue damage
- crack initiation and growth due to cracking or stress corrosion cracking
- loss of material due to general, microbiologically influenced, pitting, and crevice corrosion
- loss of material due to general, galvanic, pitting, and crevice corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion and biofouling
- crack initiation and growth due to stress corrosion cracking and cyclic loading
- reduction of neutron-absorbing capacity and loss of material due to general corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion

Staff Evaluation. 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 staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in Section 3.3.2.2 of the SRP-LR. Details of the staff's audit are documented in the staff's MNGP audit and review report. The staff's evaluation of the aging effects is discussed in the following sections.

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 staff reviewed 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 LRA Section 3.3.2.2.1.1, the applicant stated 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 stated 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 staff 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 staff determined that the use of a more recent issue of the BWRVIP chemistry program document was acceptable. The staff 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. 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 staff reviewed the Plant Chemistry program and the One-Time Inspection program and found them to be acceptable for managing aging degradation. The evaluations are documented in Sections 3.0.3.2.19 and 3.0.3.1.4 of this SER, respectively.

3.3.2.2.1.2 Spent Fuel Pool Cooling Piping, Valves, Filters, and Ion Exchangers

The staff 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 LRA Section 3.3.2.2.1.2, the applicant stated 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 staff 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 staff 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 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 staff reviewed the Plant Chemistry program, the One-Time Inspection program, and the Compressed Air Monitoring program and found them acceptable for managing aging degradation. The evaluations are documented in Sections 3.0.3.2.19, 3.0.3.1.4 and 3.0.3.2.13 of this SER, respectively.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.3.2.2.1. For those line items that apply to LRA Sections 3.3.2.2.1.1 and 3.3.2.2.1.2, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.2 Hardening and Cracking or Loss of Strength Due to Elastomer Degradation or Loss of Material Due to Wear

The staff reviewed LRA Section 3.3.2.2.2 against the criteria in SRP-LR Section 3.3.2.2.2.

In LRA Section 3.3.2.2.2, the applicant addressed **<Insert Description of Any Applicable Aging Effects/Mechanisms Provided by Tech Staff (DE staff)>**

SRP-LR Section 3.3.2.2.2 states that **<Insert Summary of the SRP-LR Provided by Tech Staff (DE staff)>**

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.3.2.2.2. For those line items that apply to LRA Section 3.3.2.2.2, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.3 Cumulative Fatigue Damage

In LRA Section 3.3.2.2.3, the applicant stated that fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Sections 4.3 and 4.9 document the staff's review of the applicant's evaluation of this TLAA for mechanical auxiliary systems and reactor building crane, respectively.

3.3.2.2.4 Crack Initiation and Growth Due to Cracking or Stress Corrosion Cracking

The staff reviewed LRA Section 3.3.2.2.4 against the criteria in SRP-LR Section 3.3.2.2.4.

> 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 LRA Section 3.3.2.2.4, the applicant stated that cracking due to SCC is not applicable to MNGP Reactor Water Cleanup System heat exchangers. Industry operating experience has shown that, 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 crack initiation and growth for these components. Therefore, no aging management is required.

The staff reviewed and determined that the applicant's assessment that SCC did not apply to the Carbon Steel shell was acceptable. Therefore, the staff 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.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.3.2.2.4. For those line items that apply to LRA Section 3.3.2.2.4, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.5 Loss of Material Due to General, Microbiologically Influenced, Pitting, and Crevice Corrosion

The staff 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 LRA Section 3.3.2.2.5, the applicant stated 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 are credited with managing the aging effect: Fire Water System program, Fire Protection program, System Condition Monitoring program, and One-Time Inspection program.

The staff 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 staff 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 staff also reviewed and 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. The staff reviewed the applicant's Fire Water System program, the Fire Protection program, the One-Time Inspection program, and the System Condition Monitoring program and found them

acceptable for managing aging degradation. The evaluation is documented in Sections 3.0.3.2.16, 3.0.3.2.15, 3.0.3.1.4, and 3.0.3.3.2 of this SER, respectively. 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.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.3.2.2.5. For those line items that apply to LRA Section 3.3.2.2.5, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.6 Loss of Material Due to General, Galvanic, Pitting, and Crevice Corrosion

The staff 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 LRA Section 3.3.2.2.6, the applicant addressed 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 staff reviewed and determined that MNGP does not have the components covered by this SRP Section.

On the basis of its review, the staff determined that MNGP does not have any components covered by SRP-LR Section 3.3.2.2.6. The staff found 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 staff 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 LRA Section 3.3.2.2.7, the applicant stated 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 staff reviewed the applicant’s Fuel Oil Chemistry program and the One-Time Inspection program and found them acceptable for managing aging degradation. The evaluation is documented in Sections 3.0.3.2.17 and 3.0.3.1.4 of this SER, respectively.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.3.2.2.7. For those line items that apply to LRA Section 3.3.2.2.7, the staff determined

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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.8 Quality Assurance for Aging Management of Nonsafety-Related Components

SER Section 3.0.4 provides the staff's evaluation of the applicant's quality assurance program.

3.3.2.2.9 Crack Initiation and Growth Due to Stress Corrosion Cracking and Cyclic Loading

The staff reviewed LRA Section 3.3.2.2.9 against the criteria in SRP-LR Section 3.3.2.2.9.

In LRA Section 3.3.2.2.9, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.3.2.2.9 states that crack initiation and growth due to stress corrosion cracking and cyclic loading could occur in the channel head and access cover, tubesheet, tubes, shell and access cover, and closure bolting of the regenerative heat exchanger and in the channel head and access cover, tubesheet, and tubes of the letdown heat exchanger in the chemical and volume control system. SRP-LR Table 3.3-1 states that further evaluation for this aging effect is only applicable to PWR plants.

The staff found 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 staff 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 LRA Section 3.3.2.2.10, the applicant stated 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 staff 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.

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 staff reviewed the Plant Chemistry program and the One-Time Inspection program and found them to be acceptable for managing aging degradation. The evaluations are documented in Sections 3.0.3.2.19 and 3.0.3.1.4 of this SER, respectively.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.3.2.2.10. For those line items that apply to LRA Section 3.3.2.2.10, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.2.11 Loss of Material Due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

The staff 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 LRA Section 3.3.2.2.11, the applicant stated 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 staff 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 staff reviewed the Buried Piping & Tanks Inspection program and the Bolting Integrity program and found them to be acceptable for managing aging degradation. The evaluations are documented in Sections 3.0.3.2.5 and 3.0.3.2.4 of this SER, respectively.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.3.2.2.11. For those line items that apply to LRA Section 3.3.2.2.11, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determines that the applicant adequately addressed the issues that were further evaluated. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.2.3 AMR Results that are Not Consistent With or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In LRA Tables 3.3.2-1 through 3.3.2-18, the staff 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 that are not addressed in the GALL Report.

In LRA Tables 3.3.2-1 through 3.3.2-18, the applicant indicated, via Notes F through J, that the combination of component type, material, environment, and aging effect requiring management does not correspond to a line item in the GALL Report, and provided information concerning how the aging effect will be managed. Specifically, Note F indicated that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicated that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicated that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicated that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicated that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

Staff Evaluation. For component type, material, and environment combinations that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation. AMR results where no aging effects were identified in LRA Tables 3.3.2-1

through 3.3.2-18 are addressed in Section 3.1.2.3.1 of this SER. Other line items that are not consistent with the GALL Report or not addressed in the GALL Report are addressed separately within each Table write-up. The staff's evaluation is discussed in the following sections.

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 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.

Specifically, the applicant stated 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 stated 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, On the basis 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 staff found 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 staff concluded that there are no applicable aging effects requiring management for the component material and environment described in the preceding discussion.

3.3.2.3.2 Auxiliary Systems – Alternate Nitrogen System – Summary of Aging Management Evaluation – Table 3.3.2-1

The staff reviewed LRA Table 3.3.2-1, which summarizes the results of AMR evaluations for the alternate nitrogen system component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.3.2.3.1, above.

3.3.2.3.3 Auxiliary Systems – Chemistry Sampling System – Summary of Aging Management Evaluation – Table 3.3.2-2

The staff reviewed LRA Table 3.3.2-2, which summarizes the results of AMR evaluations for the chemistry sampling system component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.3.2.3.1, above.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>

3.3.2.3.4 Auxiliary Systems – Circulating Water System – Summary of Aging Management Evaluation – Table 3.3.2-3

The staff reviewed LRA Table 3.3.2-3, which summarizes the results of AMR evaluations for the circulating water system component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.3.2.3.1, above.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>

3.3.2.3.5 Auxiliary Systems – Control Rod Drive System – Summary of Aging Management Evaluation – Table 3.3.2-4

The staff reviewed LRA Table 3.3.2-4, which summarizes the results of AMR evaluations for the control rod drive system component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.3.2.3.1, above.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>

3.3.2.3.6 Auxiliary Systems – Demineralized Water System – Summary of Aging Management Evaluation – Table 3.3.2-5

The staff reviewed LRA Table 3.3.2-5, which summarizes the results of AMR evaluations for the demineralized water system component groups.

In LRA Table 3.3.2-5, the applicant proposed to manage loss of material due to, pitting and crevice corrosion, and 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 staff reviewed the applicant's Plant Chemistry program and the One-Time Inspection program, and its evaluation of each is documented in Sections 3.0.3.2.19 and 3.0.3.1.4 of this SER, 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 Plant Chemistry program. 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. MNGP has chosen a different combination of AMPs to manage the AERM. The staff review determined that this combination is adequate for managing this material/environment/aging effect and found it to be acceptable.

In MNGP LRA Table 3.3.2-5, the applicant proposed 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 staff reviewed the applicant's Selective Leaching of Materials program and its evaluation is documented in Section 3.0.3.2.22 of this SER. 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 determined that this AMP is adequate for managing this material/environment/aging effect.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that the aging effect of loss of material due to MIC and selective leaching of copper alloy material exposed internally to treated water environment in LRA Table 3.3.2-5 are effectively managed using the Plant Chemistry program combined with the One-Time Inspection program, and the Selective Leaching of Materials program.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>

3.3.2.3.7 Auxiliary Systems – Emergency Diesel Generators System – Summary of Aging Management Evaluation – Table 3.3.2-6

The staff reviewed LRA Table 3.3.2-6, which summarizes the results of AMR evaluations for the emergency diesel generators system component groups.

In LRA Table 3.3.2-6, the applicant proposed 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 LRA Table 3.3.2-6, the applicant proposed 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 staff reviewed the applicant's Closed Cycle Cooling Water program, and its evaluation is documented in Section 3.0.3.2.12 of this SER. The 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-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. The staff has determined that this AMP is adequate for managing this material/environment/aging effect.

In LRA Table 3.3.2-6, the applicant proposed 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 staff reviewed the applicant's Selective Leaching of Materials program, and its evaluation is documented in Section 3.0.3.2.22 of this SER. 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 determined that this AMP is adequate for managing this material/environment/aging effect.

In LRA Table 3.3.2-6, the applicant proposed 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 LRA Table 3.3.2-6, the applicant proposed 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 staff reviewed the applicant's Fuel Oil Chemistry program, and its evaluation is documented in Section 3.0.3.2.17, and the One-Time Inspection program and its evaluation is documented in Section 3.0.3.1.4 of this SER. 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 staff review determined that the Fuel Oil Chemistry program supplemented by the One-Time Inspection program is adequate for managing these material/environment/aging effects combination.

On the basis of its review of the applicant's programs, aging effects, plant-specific and industry operating experience, the staff determined that 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 in LRA Table 3.3.2-6 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 the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>

3.3.2.3.8 Auxiliary Systems – Emergency Filtration Train System – Summary of Aging Management Evaluation – Table 3.3.2-7

The staff reviewed LRA Table 3.3.2-7, which summarizes the results of AMR evaluations for the emergency filtration train system component groups.

In LRA Table 3.3.2-7, the applicant proposed 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 staff reviewed the Selective Leaching of Materials program and its evaluation is documented in Section 3.0.3.2.22 of this SER. 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 programs, aging effects, plant-specific, and industry operating experience, the staff determined that 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 staff found that management of loss of material due to selective leaching in LRA Table 3.3.2-7 is acceptable.

3.3.2.3.9 Auxiliary Systems – Emergency Service Water System – Summary of Aging Management Evaluation – Table 3.3.2-8

The staff reviewed LRA Table 3.3.2-8, which summarizes the results of AMR evaluations for the emergency service water system component groups.

The applicant proposed to manage **<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>**

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>

3.3.2.3.10 Auxiliary Systems – Fire System – Summary of Aging Management Evaluation – Table 3.3.2-9

The staff reviewed LRA Table 3.3.2-9, which summarizes the results of AMR evaluations for the fire system component groups.

In LRA Table 3.3.2-9, the applicant proposed 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 LRA Table 3.3.2-9, the applicant proposed 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 LRA Table 3.3.2-9, the applicant proposed 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."

The staff reviewed Fire Protection program and its evaluation is documented in Section 3.0.3.2.15 of this SER. 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 6 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 staff 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 staff 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 staff issued RAI 3.3.2.3.5-1 requesting that the applicant demonstrate how the fire water system and the fire protection AMPs will manage Loss of Material - Selective Leaching for these materials.

In response to the RAI, the applicant stated...

In MNGP LRA Table 3.3.2-9, the applicant proposed 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 staff reviewed the Fire Water System program and its evaluation is documented in Section 3.0.3.2.16 fo this SER. 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. 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 staff review determined that this AMP is adequate for managing this material/environment/aging effect.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that 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 staff found 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 conclusion will be MNGP response to Request for Additional Information (RAI 3.3.2.3.5-1) requesting demonstration that these AMPs are adequate for managing this aging effect/aging mechanism.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>

3.3.2.3.11 Auxiliary Systems – Fuel Pool Cooling and Cleanup – Summary of Aging Management Evaluation – Table 3.3.2-10

The staff reviewed LRA Table 3.3.2-10, which summarizes the results of AMR evaluations for the fuel pool cooling and cleanup component groups.

In LRA Table 3.3.2-10, the applicant proposed 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 staff reviewed the applicant's Plant Chemistry program and the One-Time Inspection program, and its evaluation of each is documented in Sections 3.0.3.2.19 and 3.0.3.1.4 of this SER, 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 Plant Chemistry program. 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 review determined that the Plant Chemistry program supplemented by the One-Time Inspection program is adequate for managing these material/environment/aging effects combination.

In LRA Table 3.3.2-10, the applicant proposed 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 staff reviewed the Selective Leaching of Materials program and its evaluation is documented in Section 3.0.3.2.22 of this SER. 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 the program review, the staff found that management of loss of material due to selective leaching in LRA Table 3.3.2-7 is acceptable.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that 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 staff found 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.

3.3.2.3.12 Auxiliary Systems - Heating and Ventilation – Summary of Aging Management Evaluation - Table 3.3.2-11

The staff reviewed LRA Table 3.3.2-11, which summarizes the results of AMR evaluations for the heating and ventilation component groups.

In LRA Table 3.3.2-11, the applicant proposed 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 staff reviewed Closed Cycle Cooling Water System program, and its evaluation is documented in Section 3.0.3.2.12 of this SER. 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. The staff reviewed and determined that this AMP is adequate for managing this material/environment/aging effect.

In LRA Table 3.3.2-11, the applicant proposed 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 staff reviewed the One-Time Inspection program, and its evaluation is documented in Section 3.0.3.1.4 of this SER. 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. 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 staff reviewed and 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. 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 LRA Table 3.3.2-11, the applicant proposed 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 staff reviewed the Selective Leaching of Materials program, and its evaluation is documented in Section 3.0.3.2.22 of this SER. 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 reviewed and determined that this AMP is adequate for managing this material/environment/aging effect.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that 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 staff found that management of Loss of Material - Pitting and Crevice Corrosion and MIC, and Selective Leaching in LRA Table 3.3.2-11 is acceptable.

3.3.2.3.13 Auxiliary Systems – Instrument and Service Air System – Summary of Aging Management Evaluation – Table 3.3.2-12

The staff reviewed LRA Table 3.3.2-12, which summarizes the results of AMR evaluations for the instrument and service air system component groups.

In LRA Table 3.3.2-12, the applicant proposed 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 staff reviewed Closed Cycle Cooling Water System program, and its evaluation is documented in Section 3.0.3.2.12 of this SER. 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. The staff reviewed and determined that this AMP is adequate for managing this material/environment/aging effect.

In LRA Table 3.3.2-12, the applicant proposed 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 staff reviewed Compressed Air Monitoring program, and its evaluation is documented in Section 3.0.3.2.13 of this SER. 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 staff reviewed and determined that this AMP is adequate for managing this material/environment/aging effect

In LRA Table 3.3.2-12, the applicant proposed 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 staff reviewed the Selective Leaching of Materials program, and its evaluation is documented in Section 3.0.3.2.22 of this SER. 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 reviewed and determined that this AMP is adequate for managing this material/environment/aging effect.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that 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 staff found 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.

3.3.2.3.14 Auxiliary Systems – Radwaste Solid and Liquid System – Summary of Aging Management Evaluation – Table 3.3.2-13

The staff reviewed LRA Table 3.3.2-13, which summarizes the results of AMR evaluations for the radwaste solid and liquid system component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.3.2.3.1, above.

3.3.2.3.15 Auxiliary Systems – Reactor Building Closed Cooling Water System – Summary of Aging Management Evaluation – Table 3.3.2-14

The staff reviewed LRA Table 3.3.2-14, which summarizes the results of AMR evaluations for the reactor building closed cooling water system component groups.

In LRA Table 3.3.2-14, the applicant proposed 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 staff reviewed Closed Cycle Cooling Water System program and its evaluation is documented in Section 3.0.3.2.12 of this SER. 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. The staff reviewed and determined that this AMP is adequate for managing this material/environment/aging effect.

In LRA Table 3.3.2-14, the applicant proposed 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 staff reviewed the Selective Leaching of Materials program, and its evaluation is documented in Section 3.0.3.2.22 of this SER. 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 reviewed and determined that this AMP is adequate for managing this material/environment/aging effect.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that 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 staff found 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.

3.3.2.3.16 Auxiliary Systems – Reactor Water Cleanup System – Summary of Aging Management Evaluation – Table 3.3.2-15

The staff reviewed LRA Table 3.3.2-15, which summarizes the results of AMR evaluations for the reactor water cleanup system component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.3.2.3.1, above.

3.3.2.3.17 Auxiliary Systems – Service and Seal Water System – Summary of Aging Management Evaluation – Table 3.3.2-16

The staff reviewed LRA Table 3.3.2-16, which summarizes the results of AMR evaluations for the service and seal water system component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.3.2.3.1, above.

The applicant proposed to manage **<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>**

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>

3.3.2.3.18 Auxiliary Systems – Standby Liquid Control System – Summary of Aging Management Evaluation – Table 3.3.2-17

The staff reviewed LRA Table 3.3.2-17, which summarizes the results of AMR evaluations for the standby liquid control system component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.3.2.3.1, above.

The applicant proposed to manage **<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>**

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Strnisha)>

3.3.2.3.19 Auxiliary Systems – Wells and Domestic Water System – Summary of Aging Management Evaluation – Table 3.3.2-18

The staff reviewed LRA Table 3.3.2-18, which summarizes the results of AMR evaluations for the wells and domestic water system component groups.

In LRA Table 3.3.2-18, the applicant proposed 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 staff reviewed the One-Time Inspection program, and its evaluation is documented in Section 3.0.3.1.4 of this SER. The One-Time Inspection program is a new program consistent with the recommendations of GALL AMP XI.M32, "One-Time Inspection." 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 staff 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. 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 LRA Table 3.3.2-18, the applicant proposed 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 staff reviewed the Selective Leaching of Materials program, and its evaluation is documented in Section 3.0.3.2.22 of this SER. 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 reviewed and determined that this AMP is adequate for managing this material/environment/aging effect.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that 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 staff found 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.

Conclusion. On the basis of its review, the staff found that the applicant appropriately evaluated AMR results involving material, environment, aging effects requiring management, and AMP combinations that are not evaluated in the GALL Report. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.3.3 Conclusion

The staff concluded that the applicant provided sufficient information to demonstrate that the effects of aging for the auxiliary systems components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR 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 Aging Management of Steam and Power Conversion System

This section of the SER documents the staff's review of the applicant's aging management review (AMR) results for the steam and power conversion system components and component groups associated with the following systems:

- condensate storage system
- condensate and feedwater system
- main condenser system
- main steam system
- turbine generator system

3.4.1 Summary of Technical Information in the Application

In LRA Section 3.4, the applicant provided AMR results for the steam and power conversion system components and component groups. In LRA Table 3.4.1, “Summary of Aging Management Evaluations in Chapter VIII of NUREG-1801 for Steam and Power Conversion,” the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the steam and power conversion system components and component groups.

The applicant’s AMRs incorporated applicable operating experience in the determination of aging effects requiring management (AERMs). These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant’s review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.4.2 Staff Evaluation

The staff reviewed LRA Section 3.4 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the steam and power conversion system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

Also, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff verified that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMRs. The staff's evaluations of the AMPs are documented in Section 3.0.3 of this SER. Details of the staff's audit evaluation are documented in the MNGP audit and review report and are summarized in Section 3.4.2.1 of this SER.

The staff also performed an onsite audit of those selected AMRs that were consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.4.2.2 of the SRP-LR. The staff's audit evaluations are documented in the MNGP audit and review report and are summarized in Section 3.4.2.2 of this SER.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that were not consistent with, or not addressed in, the GALL Report. The audit and technical review included evaluating whether all plausible aging effects were identified and evaluating whether the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluations are documented in the MNGP audit and review report and are summarized in Section 3.4.2.3 of this SER. The staff's evaluation of its technical review is also documented in Section 3.4.2.3 of this SER.

Finally, the staff reviewed the AMP summary descriptions in the USAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the steam and power conversion system components.

Table 3.4-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.4, that are addressed in the GALL Report.

Table 3.4-1 Staff Evaluation for Steam and Power Conversion System Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Piping and fittings in main feedwater line, steam line and AFW piping (PWR only) (Item Number 3.4.1-01)	Cumulative fatigue damage	TLAA, evaluated in accordance with 10 CFR 54.21(c)	TLAA	This TLAA is evaluated in Section 4.3, Metal Fatigue of the RPV and Internals, and Reactor Coolant Pressure Boundary Piping and Components (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	One-Time Inspection Program (B2.1.23), Plant Chemistry Program (B2.1.25)	Consistent with GALL Report, which recommends further evaluation (See Section 3.4.2.2.2)
Auxiliary feedwater (AFW) piping (Item Number 3.4.1-03)	Loss of material due to general, pitting, and crevice corrosion, MIC, and biofouling	Plant specific		Not applicable, PWR only (See Section 3.4.2.2.3)
Oil coolers in AFW system (lubricating oil side possibly contaminated with water (Item Number 3.4.1-04)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion and MIC	Plant specific		Not applicable, PWR only (See Section 3.4.2.2.3)
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 GALL Report, which recommends further evaluation (See Section 3.4.2.2.4)
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 Program (B2.1.19)	Consistent with 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 GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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 Program (B2.1.4)	Consistent with GALL Report
Heat exchangers and coolers/condensers serviced 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 (See Section 3.4.2.1.1)
Heat exchangers and coolers/condensers serviced 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.
External surface of aboveground condensate storage tank (Item Number 3.4.1-11)	Loss of material due to general (carbon steel only), pitting, and crevice corrosion	Aboveground carbon steel tanks		Not applicable. MNGP condensate storage tanks are not within the scope of license renewal.
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 or Buried piping and tanks inspection		Not applicable. MNGP has no buried condensate storage tanks or AFW piping.
External surface of carbon steel components (Item Number 3.4.1-13)	Loss of material due to boric acid corrosion	Boric acid corrosion		Not applicable, PWR only

The staff's review of the MNGP component groups followed one of several approaches. One approach, documented in Section 3.4.2.1, involves the staff's review of the AMR results for components in the steam and power conversion system that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.4.2.2, involves the staff's review of the AMR results for components in the steam and power conversion system that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.4.2.3, involves the staff's review of the AMR results for components in the steam and power conversion system that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs that are credited to manage or

monitor aging effects of the steam and power conversion system components is documented in Section 3.0.3 of this SER.

3.4.2.1 AMR Results that are Consistent with the GALL Report

Summary of Technical Information in the Application. In LRA Section 3.4.2.1, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the steam and power conversion system components:

- Bolting Integrity Program (B2.1.4)
- Flow-Accelerated Corrosion Program (B2.1.19)
- One-Time Inspection Program (B2.1.23)
- Open-Cycle Cooling Water System Program (B2.1.24)
- Plant Chemistry Program (B2.1.25)
- Selective Leaching of Materials Program (B2.1.30)
- System Condition Monitoring Program (B2.1.32)

Staff Evaluation. In LRA Tables 3.4.2-1 through 3.4.2-5, the applicant provided a summary of AMRs for the steam and power conversion system components, and identified which AMRs it considered to be consistent with the GALL Report.

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 does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated that the AMR was consistent with the GALL Report.

Note A indicated 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. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicated 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 staff audited these line items to verify consistency with the GALL Report. The staff verified that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicated 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 is consistent

with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicated 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 staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicated that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in the MNGP audit and review report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

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 LRA Table 3.4.1, Item Number 3.4.1-09 the applicant addressed 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 stated that Item Number 3.4.1-09 is not applicable to MNGP. The applicant stated 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 staff noted that, in 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 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 staff questioned the applicant's use of Note E for these AMR entries, as no AMP was credited.

In response, the applicant stated 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 staff 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 staff then reviewed 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, 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 staff reviewed the applicant's response and found 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 staff found that the applicant appropriately addressed the aging effect/mechanism, as identified in the GALL Report.

Conclusion. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff concluded 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 concluded 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 consistent with the CLB for the period of extended operation, as required by 10 CFR54.21(a)(3).

3.4.2.2 AMR Results that are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In LRA Section 3.4.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for the steam and power conversion system components. The applicant provided information concerning how it will manage the following aging effects:

- cumulative fatigue damage
- loss of material due to general, pitting, and crevice corrosion
- loss of material due to general, pitting, and crevice corrosion, microbiologically influenced corrosion, and biofouling
- general corrosion
- loss of material due to general, pitting, crevice, and microbiologically influenced corrosion

Staff Evaluation. 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 staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in Section 3.4.2.2 of

the SRP-LR. Details of the staff's audit are documented in the staff's MNGP audit and review report. The staff's evaluation of the aging effects is discussed in the following sections.

3.4.2.2.1 Cumulative Fatigue Damage

In LRA Section 3.4.2.2.1, the applicant stated that fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Section 4.3 documents the staff's review of the applicant's evaluation of this TLAA.

3.4.2.2.2 Loss of Material Due to General, Pitting, and Crevice Corrosion

The staff reviewed MNGP LRA, Section 3.4.2.2.2, against the criteria in SRP-LR, Section 3.4.2.2.2, which states:

> The management of loss of material due to general, pitting, and crevice corrosion should be evaluated further for carbon steel piping and fittings, valve bodies and bonnets, pump casings, pump suction and discharge lines, tanks, tubesheets, channel heads, and shells except for main steam system components and for loss of material due to pitting and crevice corrosion for stainless steel tanks and heat exchanger/cooler tubes. The water chemistry program relies on monitoring and control of water chemistry based on the guidelines in EPRI guideline TR-102134 for secondary water chemistry to manage the effects of loss of material due to general, pitting, or crevice corrosion. However, corrosion may occur at locations of stagnant flow conditions. Therefore, the effectiveness of the chemistry control program should be verified to ensure that corrosion is not occurring. The GALL Report recommends further evaluation of programs to manage loss of material due to general, pitting, and crevice corrosion to verify the effectiveness of the water chemistry program. A one-time inspection of select components and susceptible locations is an acceptable method to ensure that corrosion is not occurring and that the component's intended function will be maintained during the period of extended operation.

In LRA, Section 3.4.2.2.2, the applicant stated 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 stated 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 staff's evaluation of the "Plant Chemistry" and "One-Time Inspection" programs is documented in Sections 3.0.3.2.19 and 3.0.3.1.4 of this SER, respectively. The staff found 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 staff determined 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 staff concluded that the applicant has met the criteria of SRP-LR Section 3.4.2.2.2. For those line items that apply to LRA Section 3.4.2.2.2, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.3 Loss of Material Due to General, Pitting, and Crevice Corrosion, Microbiologically Influenced Corrosion, and Biofouling

The staff reviewed LRA Section 3.4.2.2.3 against the criteria in SRP-LR Section 3.4.2.2.3.

In LRA Section 3.4.2.2.3, the applicant stated that this aging effect applies to PWRs only.

SRP-LR Section 3.4.2.2.3 states that loss of material due to general corrosion, pitting and crevice corrosion, microbiologically influenced corrosion, and biofouling could occur in carbon steel piping and fittings for untreated water from the backup water supply in the PWR auxiliary feedwater system. SRP-LR Table 3.3-1 states that further evaluation for this aging effect is only applicable to PWR plants.

The staff found that this aging effect is not applicable to MNGP.

3.4.2.2.4 Loss of Material due to General Corrosion

The staff reviewed LRA Section 3.4.2.2.4 against the criteria in SRP-LR Section 3.4.2.2.4.

> 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 212EF. 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 stated that 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 stated in the 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, the applicant stated that it will revise the LRA to eliminate reference to the pressure boundary function of the main condensers, as this function is inappropriate for these components.

The staff reviewed the applicant’s System Condition Monitoring program, and its evaluation is documented in Section 3.0.3.3.2 of this SER. The staff found 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 staff concluded that the applicant has met the criteria of SRP-LR Section 3.4.2.2.4. For those line items that apply to LRA Section 3.4.2.2.4, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.2.5 Loss of Material due to General, Pitting, Crevice, and Microbiologically Influenced Corrosion

The applicant stated in 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 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 staff concurred with the applicant’s determination that this aging effect is not applicable to MNGP.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.4.2.2.5. For those line items that apply to LRA Sections 3.4.2.2.5.1 and 3.4.2.2.5.2, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

Conclusion. On the basis of its review, for component groups evaluated in the GALL Report for which the applicant has claimed consistency with the GALL Report, and for which the GALL Report recommends further evaluation, the staff determines that the applicant adequately addressed the issues that were further evaluated. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.2.3 AMR Results that are Not Consistent With or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In LRA Tables 3.4.2-1 through 3.4.2-5, the staff 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 that are not addressed in the GALL Report.

In LRA Tables 3.4.2-1 through 3.4.2-5, the applicant indicated, via Notes F through J, that the combination of component type, material, environment, and aging effect requiring management does not correspond to a line item in the GALL Report, and provided information concerning how the aging effect will be managed. Specifically, Note F indicated that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicated that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicated that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicated that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicated that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

Staff Evaluation. For component type, material, and environment combinations that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation. AMR results where no aging effects were identified in LRA Tables 3.4.2-1 through 3.4.2-5 are addressed in Section 3.4.2.3.1 of this SER. Other line items that are not consistent with the GALL Report or not addressed in the GALL Report are addressed separately within each Table write-up. The staff's evaluation is discussed in the following sections.

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 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 stated 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 95EF [35EC]) 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 staff found 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 staff concluded 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 review of current industry research and operating experience, the staff found 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 – Table 3.4.2-1

The staff reviewed LRA Table 3.4.2-1, which summarizes the results of AMR evaluations for the condensate storage system component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.4.2.3.1, above.

3.4.2.3.3 Steam and Power Conversion System – Condensate and Feedwater System – Summary of Aging Management Evaluation – Table 3.4.2-2

The staff reviewed LRA Table 3.4.2-2, which summarizes the results of AMR evaluations for the condensate and feedwater system component groups.

In LRA Table 3.4.2-2, the applicant proposed 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 staff reviewed the One-Time Inspection program, and its evaluation is documented in Section 3.0.3.1.4 of this SER. 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. 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 staff reviewed and 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. 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.

On the basis of its review of the applicant’s programs, aging effects, plant-specific, and industry operating experience, the staff determined that the aging effect of cracking and change in material 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 staff found that management of cracking due to thermal exposure in LRA Table 3.4.2.-2 is acceptable.

<INSERT Information Provided by Tech Staff (EMEB-B/Rajan)>

3.4.2.3.4 Steam and Power Conversion System – Main Condenser System – Summary of Aging Management Evaluation – Table 3.4.2-3

The staff reviewed LRA Table 3.4.2-3, which summarizes the results of AMR evaluations for the main condenser system component groups.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Rajan)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Rajan)>

3.4.2.3.5 Steam and Power Conversion System – Main Steam System – Summary of Aging Management Evaluation – Table 3.4.2-4

The staff reviewed LRA Table 3.4.2-4, which summarizes the results of AMR evaluations for the main steam system component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.4.2.3.1, above.

3.4.2.3.6 Steam and Power Conversion System – Turbine Generator System – Summary of Aging Management Evaluation – Table 3.4.2-5

The staff reviewed LRA Table 3.4.2-5, which summarizes the results of AMR evaluations for the turbine generator system component groups.

In LRA Table 3.4.2-5, the applicant proposed 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, or for copper alloy component types of heat exchangers exposed to a wet air or gas environment, or for component types of piping and fittings exposed to a raw water environment using MNGP AMP B2.1.30, "Selective Leaching of Materials."

The staff reviewed the applicant's Selective Leaching of Materials program and its evaluation is documented in Section 3.0.3.2.22 of this SER. 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. **The staff reviewed and determined that this AMP is adequate for managing this material/environment/aging effect.**

In LRA Table 3.4.2-5, the applicant proposed to manage the loss of material due to MIC, crevice and pitting corrosion of copper alloy materials for component types of gauges, piping and fittings, and valve bodies 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 staff reviewed the applicant's Plant Chemistry program and the One-Time Inspection program, and its evaluation of each is documented in Sections 3.0.3.2.19 and 3.0.3.1.4 of this SER, 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 Plant Chemistry program. 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 review determined that the Plant Chemistry program supplemented by the One-Time Inspection program is adequate for managing these material/environment/aging effects combination.

In MNGP LRA Table 3.4.2-5, the applicant proposed to manage loss of material due to MIC, pitting, and 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 staff reviewed the applicant's System Condition Monitoring program and its evaluation is documented in Section 3.0.3.3.2 of this SER.

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined and that the aging effect of the loss of material due to MIC, pitting, and crevice corrosion of copper alloy material exposed to a wet air or gas, treated water environment and loss of material due to selective leaching of cast iron material exposed to treated water, copper alloy exposed to wet air or gas and raw water environments is effectively managed using the System Condition Monitoring program, Plant Chemistry program, One-Time Inspection program, and Selective Leaching program. On this basis, the staff found that management of the loss of material due to MIC, pitting and crevice corrosion, and selective leaching in LRA Table 3.4.2-5 is acceptable.

Conclusion. On the basis of its review, the staff found that the applicant appropriately evaluated AMR results involving material, environment, aging effects requiring management, and AMP combinations that are not evaluated in the GALL Report. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.4.3 Conclusion

The staff concluded that the applicant provided sufficient information to demonstrate that the effects of aging for the steam and power conversion system components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff 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 system, as required by 10 CFR 54.21(d).

3.5 Aging Management of Containments, Structures, and Component Supports

This section of the SER documents the staff's review of the applicant's aging management review (AMR) results for the containments, structures, component supports, and component groups associated with the following systems:

- cranes, heavy loads, rigging

- diesel fuel oil transfer house
- emergency diesel generator building
- emergency filtration train building
- fire protection barriers commodity group
- hangers and supports commodity group
- HPCI building
- intake structure
- miscellaneous SBO yard structures
- off gas stack
- off gas storage and compressor building
- plant control and cable spreading structure
- primary containment
- radioactive waste building
- reactor building
- structures affecting safety
- turbine building
- underground duct bank

3.5.1 Summary of Technical Information in the Application

In LRA Section 3.5, the applicant provided AMR results for the containments, structures, component supports, and component groups. In LRA Table 3.5.1, "Summary of Aging Management Evaluations in Chapters II and III of NUREG-1801 for Structures and Component Supports," the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the containments, structures, component supports, and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of aging effects requiring management (AERMs). These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.5.2 Staff Evaluation

The staff reviewed LRA Section 3.5 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the containments, structures, and component supports system components that are within the scope of license renewal and subject to an AMR 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).

Also, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMRs. The staff's evaluations of the AMPs are documented in Section 3.0.3 of this SER.

Details of the staff's audit evaluation are documented in the MNGP audit and review report and are summarized in Section 3.5.2.1 of this SER.

The staff also performed an onsite audit of those selected AMRs that were consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.5.2.2 of the SRP-LR. The staff's audit evaluations are documented in the MNGP audit and review report and are summarized in Section 3.5.2.2 of this SER.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that were not consistent with, or not addressed in, the GALL Report. The audit and technical review included evaluating whether all plausible aging effects were identified and evaluating whether the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluations are documented in the MNGP audit and review report and are summarized in Section 3.5.2.3 of this SER. The staff's evaluation of its technical review is also documented in Section 3.5.2.3 of this SER.

Finally, the staff reviewed the AMP summary descriptions in the USAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the containments, structures, and component supports system components.

Table 3.5-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.5, that are addressed in the GALL Report.

Table 3.5-1 Staff Evaluation for Containments, Structures, and Component Supports in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Common Components of All Types of PWR and BWR Containment				
Penetration sleeves, penetration bellows, and dissimilar metal welds (Item Number 3.5.1-01)	Cumulative fatigue damage (CLB fatigue analysis exists)	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, or crack initiation and growth due to SCC	Containment ISI and Containment leak rate test	10 CFR 50, Appendix J Program (B2.1.1), Primary Containment In-Service Inspection Program (B2.1.26)	Consistent with GALL Report, which recommends further evaluation (See Section 3.5.2.2.1.7)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Penetration sleeves, penetration bellows, and dissimilar metal welds (Item Number 3.5.1-03)	Loss of material due to corrosion	Containment ISI and Containment leak rate test	10 CFR 50, Appendix J Program (B2.1.1), Primary Containment In-Service Inspection Program (B2.1.26)	Consistent with GALL Report
Personnel airlock and equipment hatch (Item Number 3.5.1-04)	Loss of material due to corrosion	Containment ISI and Containment leak rate test	10 CFR 50, Appendix J Program (B2.1.1), Primary Containment In-Service Inspection Program (B2.1.26)	Consistent with GALL Report
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 mechanism	Containment leak rate test and Plant Technical Specifications	10 CFR 50, Appendix J Program (B2.1.1)	Consistent with GALL Report
Seals, 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	10 CFR 50, Appendix J Program (B2.1.1), Primary Containment In-Service Inspection Program (B2.1.26)	Consistent with GALL Report
PWR Concrete (Reinforced and Prestressed) and Steel Containment BWR Concrete (Mark II and III) and Steel (Mark I, II, and III) Containment				
Concrete elements: foundation, walls, dome (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
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
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

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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
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
Steel elements: liner plate, 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	10 CFR 50, Appendix J Program (B2.1.1), Primary Containment In-Service Inspection Program (B2.1.26)	Consistent with GALL Report, which recommends further evaluation (See section 3.5.2.2.1.4)
Steel elements: vent header, drywell head, torus, downcomers, 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)
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	10 CFR 50, Appendix J Program (B2.1.1), Primary Containment In-Service Inspection Program (B2.1.26)	Consistent with GALL Report. 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) are credited with managing this aging effect.

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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. There are no Prestressed containment tendons and anchorage components.
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. There are no such concrete elements.
Steel elements: vent line bellows, vent headers, downcomers (Item Number 3.5.1-17)	Cracking due to cyclic loads or Crack initiation and growth due to SCC	Containment ISI and Containment leak rate test	10 CFR 50, Appendix J Program (B2.1.1), Primary Containment In-Service Inspection Program (B2.1.26)	Consistent with GALL Report, which recommends further evaluation (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
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)	Consistent with GALL Report
Class I Structures				
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, 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, which recommends further evaluation (See Section 3.5.2.2.2.2)

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
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
Group 5: liners (Item Number 3.5.1-23)	Crack initiation and growth from SCC and loss of material due to crevice corrosion	Water Chemistry Program and Monitoring of spent fuel pool water level	Plant Chemistry Program (B2.1.25) and System Condition Monitoring Program (B2.1.32)	Consistent with GALL Report
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 Program (B2.1.31) 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 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 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		MNGP has no Group 7 (concrete tanks) or Group 8 (steel tanks) with liners
Component Supports				

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff 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, welds (Item Number 3.5.1-30)	Cumulative fatigue damage (CLB fatigue analysis exists)	TLAA, evaluated in accordance with 10 CFR 54.21(c)		This TLAA is evaluated in Section 3.5.2.2.3.2
All Groups: support members: anchor bolts, welds (Item Number 3.5.1-31)	Loss of material due to boric acid corrosion	Boric acid corrosion		Not applicable, 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 (B2.1.3)	Consistent with GALL Report
Group B1.1: high strength low-alloy bolts (Item Number 3.5.1-33)	Crack initiation and growth due to SCC	Bolting integrity		Not applicable to MNGP. There are no high strength low-alloy bolts in use at MNGP for structural applications.

The staff's review of the MNGP component groups followed one of several approaches. One approach, documented in Section 3.5.2.1, involves the staff's review of the AMR results for components in the containments, structures, and component supports that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.5.2.2, involves the staff's review of the AMR results for components in the containments, structures, and component supports that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.5.2.3, involves the staff's review of the AMR results for components in the containments, structures, and component supports that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's review of AMPs that are credited to manage or monitor aging effects of the

containments, structures, and component supports components is documented in Section 3.0.3 of this SER.

3.5.2.1 AMR Results that are Consistent with the GALL Report

Summary of Technical Information in the Application. In LRA Section 3.5.2.1, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the containments, structures, and component supports system components:

- 10 CFR 50, Appendix J Program (B2.1.1)
- ASME Section XI, Subsection IWF Program (B2.1.3)
- Buried Piping & Tanks Inspection Program (B2.1.5)
- Fire Protection Program (B2.1.17)
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program (B2.1.22)
- One-Time Inspection Program (B2.1.23)
- Plant Chemistry Program (B2.1.25)
- Primary Containment In-Service Inspection Program (B2.1.26)
- Protective Coating Monitoring & Maintenance Program (B2.1.27)
- Structures Monitoring Program (B2.1.31)
- System Condition Monitoring Program (B2.1.32)

Staff Evaluation. In LRA Tables 3.5.2-1 through 3.5.2-18, the applicant provided a summary of AMRs for the containments, structures, and component supports, and identified which AMRs it considered to be consistent with the GALL Report.

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 does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated that the AMR was consistent with the GALL Report.

Note A indicated 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. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicated 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 staff audited these line items to verify consistency with the GALL Report. The staff verified that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicated 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 is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicated 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 staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicated that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in the MNGP audit and review report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs. The staff's evaluation is discussed below.

3.5.2.1.1 Loss of Material due to Corrosion in Accessible Areas

In reviewing entries in LRA Table 3.5.2-13 for Carbon Steel, Low Alloy Steel in Treated Water and Air/Gas, the staff 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 staff asked the applicant to resolve these discrepancies. In response, as documented in applicant's letter dated August 11, 2005, the applicant stated:

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 LRA are consistent with GALL Report, the staff concluded that the applicant has appropriately addressed the aging management for the above components.

On the basis of its review, the staff found that the applicant appropriately addressed the aging effect/mechanism, as recommended by the GALL Report.

Conclusion. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff concluded 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 concluded 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 consistent with the CLB for the period of extended operation, as required by 10 CFR54.21(a)(3).

3.5.2.2 AMR Results that are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In LRA Section 3.5.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for the containments, structures, and component supports. The applicant provided information concerning how it will manage the following aging effects:

PWR and BWR Containments:

- aging of inaccessible concrete areas
- 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 the structures monitoring program
- reduction of strength and modulus of concrete structures due to elevated temperature
- loss of material due to corrosion in inaccessible areas of steel containment shell or liner plate
- loss of prestress due to relaxation, shrinkage, creep, and elevated temperature
- cumulative fatigue damage
- cracking due to cyclic loading and SCC

Class 1 Structures:

- aging of structures not covered by structures monitoring program
- aging management of inaccessible areas

Component Supports:

- aging of supports not covered by structures monitoring program
- cumulative fatigue damage due to cyclic loading

Staff Evaluation. 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 staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in Section 3.5.2.2 of the SRP-LR. Details of the staff's audit are documented in the staff's MNGP audit and review report. The staff's evaluation of the aging effects is discussed in the following sections.

3.5.2.2.1 PWR and BWR Containments

The staff reviewed LRA Section 3.5.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.1, which addresses several areas discussed below.

3.5.2.2.1.1 Aging of Inaccessible Concrete Areas.

The staff reviewed the LRA Section 3.5.2.2.1.1 against the criteria in SRP-LR Section 3.5.2.2.1.1, which states:

> Cracking, spalling, and increases in porosity and permeability due to leaching of calcium hydroxide and aggressive chemical attack; and cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel could occur in inaccessible areas of PWR concrete and steel containments; BWR Mark II concrete containments; and Mark III concrete and steel containments. The GALL Report recommends further evaluation of plant-specific programs to manage the

> aging effects for inaccessible areas if specific criteria defined in the GALL Report cannot be satisfied.

In LRA Section 3.5.2.2.1.1, the applicant stated that these aging effects/mechanisms are not applicable to the MNGP containment because it is a BWR Mark I design. Based on MNGP's containment being a BWR Mark I design, which does not include concrete as part of the containment structure, the staff found that these aging effects/mechanisims are not applicable for MNGP's containment.

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 the Structures Monitoring Program

The staff reviewed the LRA Section 3.5.2.2.1.2 against the criteria in SRP-LR Section 3.5.2.2.1.2, which states:

> Cracking, distortion, and increase in component stress level due to settlement could occur in PWR concrete and steel containments and BWR Mark II concrete containments and Mark III concrete and steel containments. Also, reduction of foundation strength due to erosion of porous concrete subfoundations could occur in all types of PWR and BWR containments. Some plants may rely on a de-watering system to lower the site ground-water level. If the plant's CLB credits a de-watering system, the GALL Report recommends verification of the continued functionality of the de-watering system during the period of extended operation. The GALL Report recommends no further evaluation if this activity is included in the scope of the applicant's structures monitoring program.

In LRA Section 3.5.2.2.1.2, the applicant addressed aging effects due to settlement. Specifically, it addressed 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 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 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 staff's evaluation of the Structures Monitoring Program is documented in Section 3.0.3.2.23 of this SER. 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 addressed the aging effects of all types of PWR and BWR containments due to erosion of porous concrete subfoundations. Specifically, it addressed 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 concluded 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 staff found 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.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.2. For those line items that apply to LRA Section 3.5.2.2.1.2, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.1.3 Reduction of Strength and Modulus of Concrete Structures Due to Elevated Temperature

The staff reviewed the LRA Section 3.5.2.2.1.3 against the criteria in SRP-LR Section 3.5.2.2.1.3, which states:

> Reduction of strength and modulus of elasticity due to elevated temperatures could occur in PWR concrete and steel containments and BWR Mark II concrete containments and Mark III concrete and steel containments. The GALL Report recommends further evaluation if any portion of the concrete containment components exceeds specified temperature limits (i.e., general area temperature 66EC [150°F] and local area temperature 93EC [200EF]).

In LRA Section 3.5.2.2.1.3, the applicant addressed aging effects due to elevated temperatures of concrete. Specifically, it discussed 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 stated 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 150EF 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 135EF and 179EF, respectively.

The staff 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 200EF. Insulation is included in the license renewal scope and is subject to AMR.

The staff found 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.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.3. For those line items that apply to LRA Section 3.5.2.2.1.3, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.1.4 Loss of Material Due to Corrosion in Inaccessible Areas of Steel Containment Shell or Liner Plate

The staff reviewed the LRA Section 3.5.2.2.1.4 against the criteria in SRP-LR Section 3.5.2.2.1.4, which states:

> Loss of material due to corrosion could occur in inaccessible areas of the steel containment shell or the steel liner plate for all types of PWR and BWR containments. The GALL Report recommends further evaluation of plant-specific programs to manage this aging effect for inaccessible areas if specific criteria defined in the GALL Report cannot be satisfied.

In LRA Section 3.5.2.2.1.4, the applicant addressed 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 discussed 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 stated 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 staff reviewed LRA Section 3.5.2.2.1.4 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 staff 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 the structures monitoring program, 3) the moisture barrier is included in the scope of the primary containment in-service inspection program, and 4) borated water leaks do not apply for BWR plants. Therefore, the staff determined that further evaluation is not necessary.

The staff found that the applicant is consistent with the GALL Report, and a plant-specific aging management program for loss of material is not required.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.4. For those line items that apply to LRA Section 3.5.2.2.1.4, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.1.5 Loss of Prestress Due to Relaxation, Shrinkage, Creep, and Elevated Temperature

The staff reviewed LRA Section 3.5.2.2.1.5 against the criteria in SRP-LR Section 3.5.2.2.1.5, which states:

> Loss of prestress forces due to relaxation, shrinkage, creep, and elevated temperature for PWR prestressed concrete containments and BWR Mark II prestressed concrete containments is a TLAA as defined in 10 CFR 54.3. TLAAs are required to be evaluated in accordance with 10 CFR 54.21(c).

In LRA Section 3.5.2.2.1.5, the applicant stated that this aging effect applies to Mark II BWR containments only.

On the basis that MNGP is not a PWR and does not have a BWR Mark II containment, the staff found that this aging effect is not applicable to MNGP.

3.5.2.2.1.6 Cumulative Fatigue Damage

In LRA Section 3.5.2.2.1.6, the applicant stated that fatigue is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). SER Sections 4.3 and 4.6 document the staff's review of the applicant's evaluation of this TLAA.

3.5.2.2.1.7 Cracking Due to Cyclic Loading and SCC

The staff reviewed the LRA Section 3.5.2.2.1.7 against the criteria in SRP-LR Section 3.5.2.2.1.7, which states:

> Cracking of containment penetrations (including penetration sleeves, penetration bellows, and dissimilar metal welds) due to cyclic loading or SCC could occur in all types of PWR and BWR containments. Cracking could also occur in vent line bellows, vent headers, and downcomers due to SCC for BWR containments. A visual VT-3 examination would not detect such cracks. The GALL Report recommends further evaluation of the inspection methods implemented to detect these aging effects.

In LRA Section 3.5.2.2.1.7, the applicant listed 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 listed 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 Examination 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 stated that the MNGP operating history on bellows replacements is limited to bellows X-16B. Leakage was identified during local leak rate testing and not as 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, the applicant stated that weld examinations utilizing optional Examination Categories E-B and E-F are not warranted. The applicant stated that 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 concluded 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 staff's 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 3.0.3.1.6 and 3.0.3.2.1 of this SER, respectively. These programs were found acceptable for managing aging of loss of material due to corrosion in accessible areas.

The staff reviewed industry operating experience on cracking of containment penetrations (including penetration sleeves, penetration bellows, and dissimilar metal welds) due to cycling loading and SCC and found it to be similar to the MNGP specific operating experience. The staff concluded that the applicant has appropriately addressed the further evaluation of this aging effect.

On the basis of its review, the staff concluded that, based on the programs identified above, the applicant has met the criteria of SRP-LR Section 3.5.2.2.1.7. For those line items that apply to LRA Section 3.5.2.2.1.7, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.2 Class 1 Structures

The staff reviewed LRA Section 3.5.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2, which addresses several areas discussed below.

3.5.2.2.2.1 Aging of Structures Not Covered by Structures Monitoring Program

The staff reviewed the LRA Section 3.5.2.2.2.1 against the criteria in SRP-LR Section 3.5.2.2.2.1, which states:

> The GALL Report recommends further evaluation of certain structure/aging effect combinations if they are not covered by the Structures Monitoring program. This includes (1) scaling, cracking, and spalling due to repeated freeze-thaw for Groups 1-3, 5, 7-9 structures; (2) scaling, cracking, spalling and increase in porosity and permeability due to leaching of calcium hydroxide and aggressive chemical attack for Groups 1-5, 7-9 structures; (3) expansion and cracking due to reaction with aggregates for Groups 1-5, 7-9 structures; (4) cracking, spalling, loss of bond, and loss of material due to corrosion of

embedded steel for Groups 1-5, 7-9 structures; (5) cracks, distortion, and increase in component stress level due to settlement for Groups 1-3, 5, 7-9 structures; (6) reduction of foundation strength due to erosion of porous concrete subfoundation for Groups 1-3, 5-9 structures; (7) loss of material due to corrosion of structural steel components for Groups 1-5, 7-8 structures; (8) loss of strength and modulus of concrete structures due to elevated temperatures for Groups 1-5; and (9) crack initiation and growth due to SCC and loss of material due to crevice corrosion of stainless steel liner for Groups 7 and 8 structures. Further evaluation is necessary only for structure/aging effect combinations not covered by the structures monitoring program. Technical details of the aging management issue are presented in SRP-LR Subsection 3.5.2.2.1.2 for items (5) and (6) and Subsection 3.5.2.2.1.3 for item (8).

In LRA Section 3.5.2.2.2.1, the applicant discussed various aging effects for concrete and carbon steel components. The applicant specifically discussed 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 stated 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 stated 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 stated 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 stated that concrete in inaccessible areas does not require aging management at MNGP. Justification is provided in the following paragraphs from Section 3.5.2.2.2.1 of the 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 stated in 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 staff's evaluation of the Structures Monitoring program is documented in Section 3.0.3.2.23 of this SER.

The staff 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 determined that the applicant has appropriately addressed these conditions. In addition, the staff reviewed the applicant's above evaluations and found them acceptable.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.1. For those line items that apply to LRA Section 3.5.2.2.2.1, the staff

determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.2.2 Aging Management of Inaccessible Areas

The staff reviewed the LRA Section 3.5.2.2.2.2 against the criteria in SRP-LR Section 3.5.2.2.2.2, which states:

> Cracking, spalling, and increases in porosity and permeability due to aggressive chemical attack, and cracking, spalling, loss of bond, and loss of material due to corrosion of embedded steel could occur in below-grade inaccessible concrete areas. The GALL Report recommends further evaluation to manage these aging effects in inaccessible areas of Groups 1-3, 5, 7-9 structures, if specific criteria defined in the GALL Report cannot be satisfied.

In LRA Section 3.5.2.2.2.2, the applicant stated 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 discussed 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 concluded 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 LRA Section 3.5.2.2.2.1.

The staff reviewed LRA Section 3.5.2.2.2.1 and found that specific criteria defined in the GALL Report are satisfied. Therefore, further evaluation is not necessary.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.2.2. For those line items that apply to LRA Section 3.5.2.2.2.2, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.3 Component Supports

The staff reviewed LRA Section 3.5.2.2.3 against the criteria in SRP-LR Section 3.5.2.2.3, which addresses several areas discussed below.

3.5.2.2.3.1 Aging of Supports Not Covered by Structures Monitoring Program.

The staff reviewed the LRA Section 3.5.2.2.3.1 against the criteria in SRP-LR Section 3.5.2.2.3.1, which states:

> The GALL Report recommends further evaluation of certain component support/aging effect combinations if they are not covered by the structures monitoring program. This includes (1) reduction in concrete anchor capacity due to degradation of the surrounding concrete, for Groups B1-B5 supports; (2) loss of material due to environmental corrosion, for Groups B2-B5 supports; and (3) reduction/loss of isolation function due to degradation of vibration isolation elements, for Group B4 supports. Further evaluation is necessary only for structure/aging effect combinations not covered by the structures monitoring program.

In LRA Section 3.5.2.2.3.1, the applicant discussed aging of component supports. It specifically discussed 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 stated 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 stated 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 discussed 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 staff reviewed component support/aging effect combinations which are not addressed by structures monitoring program and determined that they are addressed by other aging management programs. The staff concluded that the appropriate Aging Management programs were used.

The staff's evaluation of the Structures Monitoring program is documented in Section 3.0.3.2.23 of this SER.

The staff's evaluation of the System Condition Monitoring program is documented in Section 3.0.3.3.2 of this SER.

The staff's evaluation of the Buried Piping and Tanks Inspection program is documented in Section 3.0.3.2.5 of this SER.

The staff's evaluation of the Primary Containment Inservice Inspection program is documented in Section 3.0.3.1.6 of this SER.

On the basis of its review, the staff concluded that the applicant has met the criteria of SRP-LR Section 3.5.2.2.3.1. For those line items that apply to LRA Section 3.5.2.2.3.1, the staff determined 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 function(s) will be maintained consistent with the CLB during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.2.3.2 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.

Conclusion. On the basis of its 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 staff determines that the applicant adequately addressed the issues that were further evaluated. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3 AMR Results that are Not Consistent With or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In LRA Tables 3.5.2-1 through 3.5.2-18, the staff 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 that are not addressed in the GALL Report.

In LRA Tables 3.5.2-1 through 3.5.2-18, the applicant indicated, via Notes F through J, that the combination of component type, material, environment, and aging effect requiring management does not correspond to a line item in the GALL Report, and provided information concerning how the aging effect will be managed. Specifically, Note F indicated that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicated that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicated that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicated that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicated that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

Staff Evaluation. For component type, material, and environment combinations that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation. The staff's evaluation is discussed in the following sections.

3.5.2.3.1 Aging Management Review Results Where No Aging Effects Were Identified (LRA Tables 3.5.2-1 through 3.5.2-18

In 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. The applicant stated that no aging effects were identified for components fabricated from the materials and exposed to the environments described below:

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 staff'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 staff found that air/gas on stainless steel will not result in aging that will be of concern during the period of extended operation, and the staff concluded 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 staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained during the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.2.3.2 Structures and Component Supports – Cranes, Heavy Loads, Rigging – Summary of Aging Management Evaluation – Table 3.5.2-1

The staff reviewed LRA Table 3.5.2-1, which summarizes the results of AMR evaluations for the cranes, heavy loads, rigging component groups.

The applicant proposed to manage **<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar)>**

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar)>

3.5.2.3.3 Structures and Component Supports – Diesel Fuel Oil Transfer House – Summary of Aging Management Evaluation – Table 3.5.2-2

The staff reviewed LRA Table 3.5.2-2, which summarizes the results of AMR evaluations for the diesel fuel oil transfer house component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.5.2.3.1, above.

3.5.2.3.4 Structures and Component Supports – Emergency Diesel Generator Building – Summary of Aging Management Evaluation – Table 3.5.2-3

The staff reviewed LRA Table 3.5.2-3, which summarizes the results of AMR evaluations for the emergency diesel generator building component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.5.2.3.1, above.

3.5.2.3.5 Structures and Component Supports – Emergency Filtration Train Building – Summary of Aging Management Evaluation – Table 3.5.2-4

The staff reviewed LRA Table 3.5.2-4, which summarizes the results of AMR evaluations for the emergency filtration train building component groups.

The applicant proposed to manage **<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar)>**

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar>

3.5.2.3.6 Structures and Component Supports – Fire Protection Barrier – Summary of Aging Management Evaluation – Table 3.5.2-5

The staff reviewed LRA Table 3.5.2-5, which summarizes the results of AMR evaluations for the fire protection barrier commodity groups.

The applicant proposed to manage **<INSERT Information Provided by Tech Staff (SPLB-B/Wolfgang)>**

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (SPLB-B/Wolfgang)>**

<INSERT Information Provided by Tech Staff (SPLB-B/Wolfgang)>

3.5.2.3.7 Structures and Component Supports – Hangers and Supports – Summary of Aging Management Evaluation – Table 3.5.2-6

The staff reviewed LRA Table 3.5.2-6, which summarizes the results of AMR evaluations for the hangers and supports commodity groups.

The applicant proposed 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 staff reviewed ASME Section XI, Subsection IWF program, and its evaluation is documented in Section 3.0.3.2.3 of this SER. 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 are 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 this basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating, the staff determined that management of 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) in LRA Table 3.5.2-6 is effectively managed using the ASME Section XI, Subsection IWF program.

3.5.2.3.8 Structures and Component Supports – HPCI Building – Summary of Aging Management Evaluation – Table 3.5.2-7

The staff reviewed LRA Table 3.5.2-7, which summarizes the results of AMR evaluations for the HPCI building component groups.

The applicant proposed to manage **<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar)>**

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar)>

3.5.2.3.9 Structures and Component Supports – Intake Structure – Summary of Aging Management Evaluation – Table 3.5.2-8

The staff reviewed LRA Table 3.5.2-8, which summarizes the results of AMR evaluations for the intake structure component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.5.2.3.1, above.

3.5.2.3.10 Structures and Component Supports – Miscellaneous SBO Yard Structures – Summary of Aging Management Evaluation – Table 3.5.2-9

The staff reviewed LRA Table 3.5.2-9, which summarizes the results of AMR evaluations for the miscellaneous SBO yard structures component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.5.2.3.1, above.

3.5.2.3.11 Structures and Component Supports – Off Gas Stack – Summary of Aging Management Evaluation – Table 3.5.2-10

The staff reviewed LRA Table 3.5.2-10, which summarizes the results of AMR evaluations for the off gas stack component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.5.2.3.1, above.

3.5.2.3.12 Structures and Component Supports – Off Gas Storage and Compressor Building – Summary of Aging Management Evaluation – Table 3.5.2-11

The staff reviewed LRA Table 3.5.2-11, which summarizes the results of AMR evaluations for the off gas storage and compressor building component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.5.2.3.1, above.

3.5.2.3.13 Structures and Component Supports – Plant Control and Cable Spreading Structure – Summary of Aging Management Evaluation – Table 3.5.2-12

The staff reviewed LRA Table 3.5.2-12, which summarizes the results of AMR evaluations for the plant control and cable spreading structure component groups.

The applicant proposed to manage **<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar)>**

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar>

3.5.2.3.14 Structures and Component Supports – Primary Containment – Summary of Aging Management Evaluation – Table 3.5.2-13

The staff reviewed LRA Table 3.5.2-13, which summarizes the results of AMR evaluations for the primary containment component groups.

The applicant proposed 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 staff 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 3.0.3.2.19, 3.0.3.1.6, and 3.0.3.2.1 of this SER, respectively.

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.

On the basis of its review of the applicant's programs, aging effects, plant specific, and industry operating experience, the staff determined that 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 staff found that management of loss of material/crevice, MIC, and pitting corrosion in Primary Containment is acceptable.

The applicant proposed to manage **<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar)>**

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar>

3.5.2.3.15 Structures and Component Supports – Radioactive Waste Building – Summary of Aging Management Evaluation – Table 3.5.2-14

The staff reviewed LRA Table 3.5.2-14, which summarizes the results of AMR evaluations for the radioactive waste building component groups.

The applicant proposed to manage **<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar)>**

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar>

3.5.2.3.16 Structures and Component Supports – Reactor Building – Summary of Aging Management Evaluation – Table 3.5.2-15

The staff reviewed LRA Table 3.5.2-15, which summarizes the results of AMR evaluations for the reactor building component groups.

The applicant proposed to manage **<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar; SPLB-B/Wolfgang; EMCB-C/Yoder)>**

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar; SPLB-B/Wolfgang; EMCB-C/Yoder)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar; SPLB-B/Wolfgang; EMCB-C/Yoder)>

3.5.2.3.17 Structures and Component Supports – Structures Affecting Safety – Summary of Aging Management Evaluation – Table 3.5.2-16

The staff reviewed LRA Table 3.5.2-16, which summarizes the results of AMR evaluations for the structures affecting safety component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.5.2.3.1, above.

3.5.2.3.18 Structures and Component Supports – Turbine Building – Summary of Aging Management Evaluation – Table 3.5.2-17

The staff reviewed LRA Table 3.5.2-17, which summarizes the results of AMR evaluations for the turbine building component groups.

The applicant proposed to manage **<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar; SPLB-B/Wolfgang)>**

On the basis of its review of the applicant's programs, aging effects, plant-specific, and industry operating experience, the staff determined that **<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar; SPLB-B/Wolfgang)>**

<INSERT Information Provided by Tech Staff (EMEB-B/Ma, Ashar; SPLB-B/Wolfgang)>

3.5.2.3.19 Structures and Component Supports – Underground Duct Bank – Summary of Aging Management Evaluation – Table 3.5.2-18

The staff reviewed LRA Table 3.5.2-18, which summarizes the results of AMR evaluations for the underground duct bank component groups. The results of these evaluations are all consistent with the GALL Report.

Conclusion. On the basis of its review, the staff found that the applicant appropriately evaluated AMR results involving material, environment, aging effects requiring management, and AMP combinations that are not evaluated in the GALL Report. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.5.3 Conclusion

The staff concluded that the applicant provided sufficient information to demonstrate that the effects of aging for the containments, structures, and component supports that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the containments, structures, and component supports, as required by 10 CFR 54.21(d).

3.6 Aging Management of Electrical and Instrumentation and Controls

This section of the SER documents the staff's review of the applicant's aging management review (AMR) results for the electrical and instrumentation and controls (I&C) components and component groups associated with the following systems:

- electrical penetrations commodity group
- fuse holders commodity group
- non-EQ cables and connections commodity group
- offsite power/SBO recovery path commodity group

3.6.1 Summary of Technical Information in the Application

In LRA Section 3.6, the applicant provided AMR results for the electrical and I&C components and component groups. In LRA Table 3.6.1, "Summary of Aging Management Evaluations in Chapter VI of NUREG-1801 for Electrical Components," the applicant provided a summary comparison of its AMRs with the AMRs evaluated in the GALL Report for the electrical and I&C components and component groups.

The applicant's AMRs incorporated applicable operating experience in the determination of aging effects requiring management (AERMs). These reviews included evaluation of plant-specific and industry operating experience. The plant-specific evaluation included reviews of condition reports and discussions with appropriate site personnel to identify AERMs. The applicant's review of industry operating experience included a review of the GALL Report and operating experience issues identified since the issuance of the GALL Report.

3.6.2 Staff Evaluation

The staff reviewed LRA Section 3.6 to determine if the applicant provided sufficient information to demonstrate that the effects of aging for the electrical and I&C components that are within the scope of license renewal and subject to an AMR 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).

Also, the staff performed an onsite audit of AMRs to confirm the applicant's claim that certain identified AMRs were consistent with the GALL Report. The staff did not repeat its review of the matters described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant had identified the appropriate GALL AMRs. The staff's evaluations of the AMPs are documented in Section 3.0.3 of this SER. Details of the staff's audit evaluation are documented in the MNGP audit and review report and are summarized in Section 3.6.2.1 of this SER.

The staff also performed an onsite audit of those selected AMRs that were consistent with the GALL Report and for which further evaluation is recommended. The staff confirmed that the applicant's further evaluations were consistent with the acceptance criteria in Section 3.6.2.2 of the SRP-LR. The staff's audit evaluations are documented in the MNGP audit and review report and are summarized in Section 3.6.2.2 of this SER.

The staff performed an onsite audit and conducted a technical review of the remaining AMRs that were not consistent with, or not addressed in, the GALL Report. The audit and technical review included evaluating whether all plausible aging effects were identified and evaluating whether the aging effects listed were appropriate for the combination of materials and environments specified. The staff's audit evaluations are documented in the MNGP audit and review report and are summarized in Section 3.6.2.3 of this SER. The staff's evaluation of its technical review is also documented in Section 3.6.2.3 of this SER.

Finally, the staff reviewed the AMP summary descriptions in the USAR supplement to ensure that they provided an adequate description of the programs credited with managing or monitoring aging for the electrical and I&C components.

Table 3.6-1 below provides a summary of the staff's evaluation of components, aging effects/mechanisms, and AMPs listed in LRA Section 3.6, that are addressed in the GALL Report.

The staff's review of the MNGP component groups followed one of several approaches. One approach, documented in Section 3.6.2.1, involves the staff's review of the AMR results for components in the electrical and I&C system that the applicant indicated are consistent with the GALL Report and do not require further evaluation. Another approach, documented in Section 3.6.2.2, involves the staff's review of the AMR results for components in the electrical and I&C system that the applicant indicated are consistent with the GALL Report and for which further evaluation is recommended. A third approach, documented in Section 3.6.2.3, involves the staff's review of the AMR results for components in the electrical and I&C system that the applicant indicated are not consistent with, or not addressed in, the GALL Report. The staff's

review of AMPs that are credited to manage or monitor aging effects of the electrical and I&C components is documented in Section 3.0.3 of this SER.

Table 3.6-1 Staff Evaluation for Electrical and Instrumentation and Controls Components in the GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Electrical equipment subject to 10 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, Environmental Qualification of Electrical Equipment (EQ)
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 & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B2.1.15)	Consistent with GALL Report
Electrical cables used in instrumentation circuits not subject to 10 CFR 50.49 EQ requirements that are sensitive to reduction in conductor insulation resistance (IR) (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 program 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 Program (B2.1.16)	Consistent with GALL Report

Component Group	Aging Effect/ Mechanism	AMP in GALL Report	AMP in LRA	Staff Evaluation
Inaccessible medium-voltage (2 kV to 15 kV) cables (e.g., installed in conduit or direct buried) 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); water tress caused by moisture intrusion	Aging management program for inaccessible medium-voltage cables not subject to 10 CFR 50.49 EQ requirements	Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program (B2.1.21)	Consistent with GALL Report
Electrical connectors not subject to 10 CFR 50.49 EQ requirements that are exposed to borated water leakage (Item Number 3.6.1-05)	Corrosion of connector contact surfaces caused by intrusion of borated water	Boric acid corrosion		Not applicable, PWR only

3.6.2.1 AMR Results that are Consistent with the GALL Report

Summary of Technical Information in the Application. In LRA Section 3.6.2.1, the applicant identified the materials, environments, and aging effects requiring management. The applicant identified the following programs that manage the aging effects related to the electrical and I&C components:

- Bus Duct Inspection Program (B2.1.6)
- Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program (B2.1.15)
- Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program (B2.1.16)
- Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program (B2.1.21).

Staff Evaluation. In LRA Tables 3.6.2-1 through 3.6.2-4, the applicant provided a summary of AMRs for the electrical and I&C components, and identified which AMRs it considered to be consistent with the GALL Report.

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 does not recommend further evaluation, the staff performed an audit and review to determine whether the plant-specific

components contained in these GALL Report component groups were bounded by the GALL Report evaluation.

The applicant provided a note for each AMR line item. The notes described how the information in the tables aligns with the information in the GALL Report. The staff audited those AMRs with Notes A through E, which indicated that the AMR was consistent with the GALL Report.

Note A indicated 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. The staff audited these line items to verify consistency with the GALL Report and the validity of the AMR for the site-specific conditions.

Note B indicated 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 staff audited these line items to verify consistency with the GALL Report. The staff verified that the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note C indicated 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 is consistent with the AMP identified by the GALL Report. This note indicates that the applicant was unable to find a listing of some system components in the GALL Report. However, the applicant identified a different component in the GALL Report that had the same material, environment, aging effect, and AMP as the component that was under review. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the AMR line item of the different component was applicable to the component under review and whether the AMR was valid for the site-specific conditions.

Note D indicated 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 staff audited these line items to verify consistency with the GALL Report. The staff verified whether the AMR line item of the different component was applicable to the component under review. The staff verified whether the identified exceptions to the GALL AMPs had been reviewed and accepted by the staff. The staff also determined whether the AMP identified by the applicant was consistent with the AMP identified in the GALL Report and whether the AMR was valid for the site-specific conditions.

Note E indicated that the AMR line item is consistent with the GALL Report for material, environment, and aging effect, but a different aging management program is credited. The staff audited these line items to verify consistency with the GALL Report. The staff also determined whether the identified AMP would manage the aging effect consistent with the AMP identified by the GALL Report and whether the AMR was valid for the site-specific conditions.

The staff conducted an audit and review of the information provided in the LRA, as documented in the MNGP audit and review report. The staff did not repeat its review of the matters

described in the GALL Report; however, the staff did verify that the material presented in the LRA was applicable and that the applicant identified the appropriate GALL Report AMRs.

The staff reviewed the LRA to confirm that the applicant (1) provided a brief description of the system, components, materials, and environment; (2) stated that the applicable aging effects were reviewed in the GALL Report, and (3) identified those aging effects for the electrical and I&C components that are subject to an AMR. On the basis of its audit and review, the staff determined that, for AMRs not requiring further evaluation, as identified in LRA Table 3.6.1, the applicant's references to the GALL Report are acceptable and no further staff review is required.

Conclusion. The staff evaluated the applicant's claim of consistency with the GALL Report. The staff also reviewed information pertaining to the applicant's consideration of recent operating experience and proposals for managing associated aging effects. On the basis of its review, the staff concluded 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 concluded 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 consistent with the CLB for the period of extended operation, as required by 10 CFR54.21(a)(3).

3.6.2.2 AMR Results that are Consistent with the GALL Report, for Which Further Evaluation is Recommended

Summary of Technical Information in the Application. In LRA Section 3.6.2.2, the applicant provided further evaluation of aging management as recommended by the GALL Report for the electrical and I&C components. The applicant provided information concerning how it will manage the following aging effects:

- electrical equipment subject to environmental qualification

Staff Evaluation. 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 staff audited and reviewed the applicant's evaluation to determine whether it adequately addressed the issues that were further evaluated. In addition, the staff reviewed the applicant's further evaluations against the criteria contained in Section 3.6.2.2 of the SRP-LR. Details of the staff's audit are documented in the staff's MNGP audit and review report. The staff's evaluation of the aging effects is discussed in the following sections.

3.6.2.2.1 Electrical Equipment Subject to Environmental Qualification

In LRA Section 3.6.2.2.1, the applicant stated that environmental qualification is a TLAA, as defined in 10 CFR 54.3. Applicants must evaluate TLAAs in accordance with 10 CFR 54.21(c)(1). Section 4.7 of this SER documents the staff's review of the applicant's evaluation of this TLAA.

Conclusion. On the basis of its 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 staff determines that the applicant adequately

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

3.6.2.3 AMR Results that are Not Consistent With or Not Addressed in the GALL Report

Summary of Technical Information in the Application. In LRA Tables 3.6.2-1 through 3.6.2-4, the staff 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 that are not addressed in the GALL Report.

In LRA Tables 3.6.2-1 through 3.6.2-4, the applicant indicated, via Notes F through J, that the combination of component type, material, environment, and aging effect requiring management does not correspond to a line item in the GALL Report, and provided information concerning how the aging effect will be managed. Specifically, Note F indicated that the material for the AMR line item component is not evaluated in the GALL Report. Note G indicated that the environment for the AMR line item component and material is not evaluated in the GALL Report. Note H indicated that the aging effect for the AMR line item component, material, and environment combination is not evaluated in the GALL Report. Note I indicated that the aging effect identified in the GALL Report for the line item component, material, and environment combination is not applicable. Note J indicated that neither the component nor the material and environment combination for the line item is evaluated in the GALL Report.

Staff Evaluation. For component type, material, and environment combinations that are not evaluated in the GALL Report, the staff reviewed the applicant's evaluation to determine whether the applicant had demonstrated that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the CLB during the period of extended operation. The staff's evaluation is discussed in the following sections.

3.6.2.3.1 Aging Management Review Results Where No Aging Effects Were Identified (LRA Tables 3.6.2-1 through 3.6.2-4)

In LRA Tables 3.6.2-1 through 3.6.2-4, the applicant identified AMR results line-items where no aging effects were identified as a result of the aging review process. The applicant stated that no aging effects were identified for components fabricated from the materials and exposed to the environments described below:

In LRA Table 3.6.2-1, the applicant included one AMR results line item where no aging effects were identified as a result of its aging review process. Specifically, the applicant stated that no aging effects occur when components fabricated from epoxy, fiberglass, and hypalon paint material are 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 135EF. 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 135EF 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 staff found 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 staff concluded 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.

(1) <u>Components fabricated from various insulating materials such as Phenolic or Melamine exposed to heat or radiation</u>

The average temperature where fuse holders are located is 85EF 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 205EF 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 205EF 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 staff found 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 staff concluded 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.

(2) <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 mechanism associated with power circuit operations. Operating low-current fuse holders below the design current rating will eliminate the aging effects due to 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 staff found 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 staff concluded 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 staff found 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 staff concluded 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 staff found 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 to be of sufficient magnitude to create aging effects. Therefore, the staff concluded 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 staff found 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 staff concluded 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 staff found 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 staff concluded 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 staff found 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 staff concluded 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) <u>Non-Segregated Phase Bus</u>

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 107EF (42EC) outdoors and normal background radiation levels, and is subject to an average temperature of 85EF (29EC) 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 staff found 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 staff concluded 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 staff found 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 staff concluded 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 staff found 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 staff concluded 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.

Effect of thermal cycling on bolted connections:

This item is addressed in Section 3.6.2.3.5 of this report.

On the basis of its review of current industry research and operating experience, the staff found 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 staff concluded that there are no applicable aging effects requiring management for porcelain components exposed to an air environment.

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 staff found 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 staff concluded 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 staff found 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 staff concluded 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 staff found 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 staff concluded 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 staff found 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 staff concluded 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 staff found 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 staff concluded 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 staff found 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 staff concluded 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 staff found 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 staff concluded 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 staff found 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 staff concluded 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 3.6.2.3.4 of this report.

On the basis of the staff audit and review of the MNGP LRA, the GALL Report and technical references for these materials and environments, the staff found 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 – Electrical Penetrations Commodity Group – Summary of Aging Management Evaluation – Table 3.6.2-1

The staff reviewed LRA Table 3.6.2-1, which summarizes the results of AMR evaluations for the electrical penetrations commodity group component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.6.2.3.1, above.

3.6.2.3.3 Electrical Components – Fuse Holders Commodity Group – Summary of Aging Management Evaluation – Table 3.6.2-2

The staff reviewed LRA Table 3.6.2-2, which summarizes the results of AMR evaluations for the fuse holders commodity group component groups. All ARM results for this table are discussed in Section 3.6.2.3.1 of this SER, above.

3.6.2.3.4 Electrical Components – Non-EQ Cables and Connections Commodity Group – Summary of Aging Management Evaluation – Table 3.6.2-3

The staff reviewed LRA Table 3.6.2-3, which summarizes the results of AMR evaluations for the non-EQ cables and connections commodity group component groups. All lines in this table were consistent with the GALL Report or were included in the discussion in Section 3.6.2.3.1, above.

3.6.2.3.5 Electrical Components – Off Site Power/SBO Recovery Path Commodity Group – Summary of Aging Management Evaluation – Table 3.6.2-4

The staff reviewed LRA Table 3.6.2-4, which summarizes the results of AMR evaluations for the off site power/SBO recovery path commodity group component groups.

The applicant proposed 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 staff reviewed Bus Duct Inspection program and its evaluation is documented in Section 3.0.3.3.1 of this SER. 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 staff found that 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 the Bus Duct Inspection program. On the basis of its review of the applicant's program, aging effects, plant-specific, and industry operating experience, the staff determined 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 review, the staff found that the applicant appropriately evaluated AMR results involving material, environment, aging effects requiring management, and AMP combinations that are not evaluated in the GALL Report. The staff found that the applicant has demonstrated that the effects of aging will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

3.6.3 Conclusion

The staff concluded that the applicant provided sufficient information to demonstrate that the effects of aging for the electrical and I&C components that are within the scope of license renewal and subject to an AMR will be adequately managed so that the intended function(s) will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3).

The staff also reviewed the applicable USAR supplement program summaries and concludes that they adequately describe the AMPs credited for managing aging of the electrical and I&C system as required by 10 CFR 54.21(d).

3.7 Conclusion for Aging Management

The staff has reviewed the information in LRA Section 3, "Aging Management Review Results," and Appendix B, "Aging Management Programs." On the basis of its review of the AMR results and AMPs, the staff concluded that the applicant has demonstrated that the aging effects will be adequately managed so that the intended functions will be maintained consistent with the CLB for the period of extended operation, as required by 10 CFR 54.21(a)(3). The staff also reviewed the applicable USAR supplement program summaries and concludes that the USAR supplement adequately describes the AMPs credited for managing aging as required by 10 CFR 54.21(d).

With regard to these matters, the NRC staff has concluded that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis, and that any changes made to the MNGP current licensing basis, in order to comply with 10 CFR 54.21(a)(3), are in accord with the Atomic Energy Act of 1954, as amended, and NRC regulations.

SECTION 4

TIME-LIMITED AGING ANALYSES

4.1 Identification of Time-Limited Aging Analyses

This section discusses the identification of time-limited aging analyses (TLAAs). Nuclear Management Company, LLC (NMC or the applicant) discusses the TLAAs in Sections 4.2 through 4.10 of its license renewal application (LRA). Sections 4.2 through 4.11, of this safety evaluation report (SER), document the review of the TLAAs conducted by the staff of the U.S. Nuclear Regulatory Commission (NRC or the staff).

TLAAs are certain plant-specific safety analyses that involve time-limited assumptions defined by the current operating term. Pursuant to Title 10, Section 54.21(c)(1), of the *Code of Federal Regulations* [10 CFR 54.21(c)(1)], the applicant for license renewal must provide a list of TLAAs, as defined in 10 CFR 54.3.

In addition, pursuant to 10 CFR 54.21(c)(2), an applicant must provide a list of plant-specific exemptions granted under 10 CFR 50.12 that are based on TLAAs. For any such exemptions, the applicant must provide an evaluation that justifies the continuation of the exemptions for the period of extended operation.

4.1.1 Summary of Technical Information in the Application

To identify the TLAAs, the applicant evaluated calculations for the Monticello Nuclear Generating Plant (MNGP) against the six criteria specified in 10 CFR 54.3. The applicant indicated that it had identified the calculations that met the six criteria by searching the current licensing basis (CLB). The CLB includes the updated safety analysis report (USAR), engineering calculations, technical reports, engineering work requests, licensing correspondence, and applicable vendor reports. The applicant listed the following applicable TLAAs in LRA Table 4.1-1, “List of MNGP Time-Limited Aging Analyses (TLAAs):”

- RPV materials USE reduction due to neutron embrittlement
- adjusted reference temperature (ART) for RPV materials due to neutron embrittlement
- reflood thermal shock analysis of the RPV
- reflood thermal shock analysis of the RPV core shroud
- RPV thermal limit analysis: operating P-T limits
- RPV circumferential weld examination relief
- RPV axial weld failure probability

- RPV fatigue analyses
- fatigue analysis of RPV internals
- ASME Section III Class 1 reactor coolant pressure boundary (RCPB) piping and fatigue analysis
- RCPB Section III Class 2 and 3, USAS B31.1 piping and components
- irradiation assisted stress corrosion cracking
- effects of reactor coolant environment
- fatigue analysis of the suppression chamber, vents, and downcomers
- fatigue analysis of the SRV piping inside the suppression chamber and internal structures
- fatigue analysis of suppression chamber external piping and penetrations
- drywell-to-suppression chamber vent line bellows fatigue analysis
- primary containment process penetration bellows fatigue analysis
- environmental qualification of electrical equipment (EQ)
- stress relaxation of core plate rim holddown bolts
- concrete containment tendon prestress
- reactor building crane load cycles
- fatigue analyses of high pressure coolant injection and reactor core cooling turbine exhaust penetrations

Pursuant to 10 CFR 54.21(c)(2), the applicant stated that it did not identify any exemptions granted under 10 CFR 50.12 that were based on a TLAA, as defined in 10 CFR 54.3.

4.1.2 Staff Evaluation

In LRA Section 4.1, the applicant identified the TLAAs applicable to MNGP; the applicant also discussed exemptions based on these TLAAs. The staff reviewed the information to determine if the applicant had provided adequate information to meet the requirements of 10 CFR 54.21(c)(1) and 10 CFR 54.21(c)(2).

As defined in 10 CFR 54.3, TLAAs are analyses that meet the following six criteria:

(196) involve systems, structures, and components that are within the scope of license renewal, as delineated in 10 CFR 54.4(a)

(197) consider the effects of aging

(198) involve time-limited assumptions defined by the current operating term (40 years)

(199) are determined to be relevant by the applicant in making a safety determination

(200) involve conclusions, or provide the basis for conclusions, related to the capability of the system, structure, and component to perform its intended functions, as delineated in 10 CFR 54.4(b)

(201) are contained or incorporated by reference in the current licensing basis

The applicant provided a list of common TLAAs from NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," dated July 2001. The applicant listed those TLAAs that are applicable to MNGP, in LRA Table 4.1-1, "List of MNGP Time-Limited Aging Analyses (TLAAs)."

As required by 10 CFR 54.21(c)(2), an applicant must provide a list of all the exemptions granted under 10 CFR 50.12 that are based on a TLAA and evaluated and justified for continuation through the period of extended operation. In its LRA, the applicant stated that each active exemption was reviewed to determine whether the exemption was based on a TLAA. The applicant did not identify any TLAA-based exemptions. On the basis of the information provided by the applicant with regard to the process used to identify TLAA-based exemptions, as well as the results of the applicant's search, the staff concluded that the applicant identified no TLAA-based exemptions that are justified for continuation through the period of extended operation, in accordance with 10 CFR 54.21(c)(2).

4.1.3 Conclusion

On the basis of its review, the staff concluded that the applicant has provided an acceptable list of TLAAs, as required by 10 CFR 54.21(c)(1). The staff has also confirmed that no exemptions to 10 CFR 50.12 have been granted on the basis of a TLAA, as required by 10 CFR 54.21(c)(2).

4.2 Neutron Embrittlement of the Reactor Vessel and Internals

The materials of the reactor pressure vessel (RPV) and internals are subject to embrittlement due to high energy (E > 1 MeV) neutron exposure. Embrittlement means the material has lower toughness (i.e., will absorb less strain energy during a crack or rupture), thus allowing a crack to propagate more easily under thermal and/or pressure loading. Toughness (indirectly measured in foot-pounds of absorbed energy in a Charpy impact test) is temperature-dependent in ferritic materials. An initial nil-ductility reference temperature (RT_{NDT}), the temperature associated with the transition from ductile to brittle behavior, is determined for vessel materials through a combination of Charpy and drop weight testing. Toughness increases with temperature up to a maximum value called the "upper-shelf energy" (USE). Neutron embrittlement causes an increase in the RT_{NDT} and a decrease in the USE of RPV steels. The increase or shift in the initial nil-ductility reference temperature (^{a}RTNDT) means higher temperatures are required for the material to continue to act in a ductile manner. To

reduce the potential for brittle fracture during RPV operation by accounting for the changes in material toughness as a function of neutron radiation exposure (fluence), operating pressure-temperature (P-T) limit curves are included in plant technical specifications. The P-T curves account for the decrease in material toughness associated with a given fluence, which is used to predict the loss in toughness of the RPV materials. Based on the projected drop in toughness for a given fluence, the P-T curves are generated to provide a minimum temperature limit associated with the vessel pressure. The P-T curves are determined by the RT_{NDT} and $^{a}RT_{NDT}$ values for the licensed operating period along with appropriate margins.

4.2.1 RPV Materials USE Reduction Due to Neutron Embrittlement

4.2.1.1 Summary of Technical Information in the Application

In LRA Section 4.2.1, the applicant summarized the evaluation of the RPV materials USE reduction due to neutron embrittlement for the period of extended operation. USE is the standard industry parameter used to indicate the maximum toughness of a material at high temperature. 10 CFR 50, Appendix G requires the predicted end-of-life Charpy impact test USE for RPV materials to be at least 50 ft-lb (absorbed energy), unless an approved analysis supports a lower value. Initial unirradiated test data are available for only one plate heat for the MNGP RPV to demonstrate a minimum 50 ft-lb USE by standard methods. End-of-life fracture energy was evaluated by using an equivalent margin analysis (EMA) methodology approved by the NRC in NEDO-32205-A (Reference 1) for all other materials. This analysis confirmed that an adequate margin of safety against fracture, equivalent to 10 CFR 50, Appendix G requirements, does exist. The end-of-life USE calculations satisfy the criteria of 10 CFR 54.3(a). As such, these calculations are a TLAA.

4.2.1.2 Staff Evaluation

<INSERT Supplemental Information, to be provided by Tech Staff (EMCB-A/Elliot)>

4.2.1.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of RPV materials USE reduction due to neutron embrittlement in Section A3.1 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the RPV materials USE reduction due to neutron embrittlement is adequate.

4.2.1.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), regarding the RPV materials USE reduction due to neutron embrittlement, that the analyses have been projected to the end of the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.2.2 Adjusted Reference Temperature (ART) for RPV Materials Due to Neutron Embrittlement

4.2.2.1 Summary of Technical Information in the Application

In LRA Section 4.2.2, the applicant summarized the evaluation of the adjusted reference temperature (ART) for RPV materials due to neutron embrittlement for the period of extended operation. The initial RT_{NDT}, nil-ductility reference temperature, is the temperature at which a non-irradiated metal (ferritic steel) changes in fracture characteristics going from ductile to brittle behavior $^{a}RT_{NDT}$ was evaluated according to the procedures in the ASME Code, Paragraph NB-2331. Neutron embrittlement raises the initial nil-ductility reference temperature. 10 CFR 50, Appendix G defines the fracture toughness requirements for the life of the vessel. The shift to the initial nil-ductility reference temperature ($^{a}RT_{NDT}$) is evaluated as the difference in the 30 ft-lb index temperatures from the average Charpy curves measured before and after irradiation. This increase ($^{a}RT_{NDT}$) means that higher temperatures are required for the material to continue to act in a ductile manner. The ART is defined as RT_{NDT} + $^{a}RT_{NDT}$ + margin. The margin is defined in RG 1.99. The P-T curves are developed from the ART for the RPV materials. These are determined by the unirradiated RT_{NDT} and by the $^{a}RT_{NDT}$ calculations for the licensed operating period. RG 1.99 defines the calculation methods for $^{a}RT_{NDT}$, ART, and end-of-life USE. The $^{a}RT_{NDT}$ and ART calculations meet the criteria of 10 CFR 54.3(a). As such, they are TLAAs.

4.2.2.2 Staff Evaluation

<INSERT Supplemental Information, to be provided by Tech Staff (EMCB-A/Elliot)>

4.2.2.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of adjusted reference temperature (ART) for RPV materials due to neutron embrittlement in Section A3.1 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the adjusted reference temperature (ART) for RPV materials due to neutron embrittlement is adequate.

4.2.2.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), regarding the adjusted reference temperature (ART) for RPV materials due to neutron embrittlement, that the analyses have been projected to the end of the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.2.3 Reflood Thermal Shock Analysis of the RPV

4.2.3.1 Summary of Technical Information in the Application

In LRA Section 4.2.3, the applicant summarized the evaluation of the reflood thermal shock analysis of the RPV for the period of extended operation. The MNGP USAR includes an end-of-life thermal shock analysis performed on the RPV for a design basis LOCA followed by a low-pressure coolant injection. The effects of neutron embrittlement assumed by this thermal shock analysis will change with an increase in the licensed operating period. This analysis satisfies the criteria of 10 CFR 54.3(a). As such, this analysis is a TLAA.

4.2.3.2 Staff Evaluation

<INSERT Supplemental Information, to be provided by Tech Staff (EMCB-A/Elliot)>

4.2.3.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of reflood thermal shock analysis of the RPV in Section A3.1 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the reflood thermal shock analysis of the RPV is adequate.

4.2.3.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), regarding the reflood thermal shock analysis of the RPV, that the analyses remain valid for the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.2.4 Reflood Thermal Shock Analysis of the RPV Core Shroud

4.2.4.1 Summary of Technical Information in the Application

In LRA Section 4.2.4, the applicant summarized the evaluation of the reflood thermal shock analysis of the RPV core shroud for the period of extended operation. Radiation embrittlement may affect the ability of RPV internals, particularly the core shroud to withstand a low-pressure coolant injection thermal shock transient. The analysis of core shroud strain due to reflood thermal shock is a TLAA because it is part of the current licensing basis, supports a safety determination, and is based on the calculated lifetime neutron fluence.

4.2.4.2 Staff Evaluation

<INSERT Supplemental Information, to be provided by Tech Staff (EMCB-A/Elliot)>

4.2.4.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of reflood thermal shock analysis of the RPV core shroud in Section A3.1 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the reflood thermal shock analysis of the RPV core shroud is adequate.

4.2.4.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), regarding the reflood thermal shock analysis of the RPV core shroud, that the analyses remain valid for the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.2.5 RPV Thermal Limit Analysis: Operating Pressure – Temperature Limits

4.2.5.1 Summary of Technical Information in the Application

In LRA Section 4.2.5, the applicant summarized the evaluation of the RPV thermal limit analysis: operating pressure-temperature (P-T) limits for the period of extended operation. The RPV thermal limit analysis: operating P-T limits. The ART is the value of (Initial RT_{NDT} + $^{a}RT_{NDT}$ + margins for uncertainties) at a specific location. Neutron embrittlement increases the ART. Thus, the minimum metal temperature at which an RPV is allowed to be pressurized increases. The ART of the limiting beltline material is used to correct the beltline P-T limits to account for irradiation effects. 10 CFR Part 50, Appendix G requires RPV thermal limit analyses to determine operating pressure-temperature (P-T) limits for boltup, hydrotest, pressure tests and normal operating and anticipated operational occurrences. Operating limits for pressure and temperature are required for three categories of operation: (1) hydrostatic pressure tests and leak tests, referred to as Curve A; (2) non-nuclear heatup/cooldown and low-level physics tests, referred to as Curve B; and (3) core critical operation, referred to as Curve C. Pressure/temperature limits are developed for three vessel regions: the upper vessel region, the core beltline region, and the lower vessel bottom head region. The calculations associated with generation of the P-T curves satisfy the criteria of 10 CFR 54.3(a). As such, this topic is a TLAA.

4.2.5.2 Staff Evaluation

<INSERT Supplemental Information, to be provided by Tech Staff (EMCB-A/Elliot)>

4.2.5.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of RPV thermal limit analysis: operating P-T limits in Section A3.1 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the RPV thermal limit analysis: operating P-T limits is adequate.

4.2.5.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), regarding the RPV thermal limit analysis: operating P-T limits, that the analyses have been projected to the end of the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.2.6 RPV Circumferential Weld Examination Relief

4.2.6.1 Summary of Technical Information in the Application

In LRA Section 4.2.6, the applicant summarized the evaluation of the RPV circumferential weld examination relief for the period of extended operation. Relief from RPV circumferential weld examination requirements under GL 98-05 is based on probabilistic assessments that predict an acceptable probability of failure per reactor operating year. The analysis is based on RPV metallurgical conditions as well as flaw indication sizes and frequencies of occurrence that are expected at the end of a licensed operating period. MNGP has received this relief for the remaining 40-year licensed operating period. The circumferential weld examination relief analysis meets the requirements of 10 CFR 54.3(a). As such, they are a TLAA.

4.2.6.2 Staff Evaluation

<INSERT Supplemental Information, to be provided by Tech Staff (EMCB-A/Elliot)>

4.2.6.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of RPV circumferential weld examination relief in Section A3.1 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the RPV circumferential weld examination relief is adequate.

4.2.6.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), regarding the RPV circumferential weld examination relief, that the analyses have been projected to the end of the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.2.7 RPV Axial Weld Failure Probability

4.2.7.1 Summary of Technical Information in the Application

In LRA Section 4.2.7, the applicant summarized the evaluation of the RPV axial weld failure probability for the period of extended operation. The BWRVIP recommendations for inspection of RPV shell welds contain generic analyses supporting an NRC SER conclusion that the generic-plant axial weld failure rate is no more than 5×10^{-6} per reactor year. BWRVIP-05 showed that this axial weld failure rate of 5×10^{-6} per reactor year is orders of magnitude greater than the 40-year end-of-life circumferential weld failure probability, and used this analysis to justify relief from inspection of the circumferential welds as described in Section 4.2.6. MNGP received relief from the circumferential weld inspections for the remaining 40-year licensed operating period. The axial weld failure probability analysis meets the requirements of 10 CFR 54.3(a). As such, it is a TLAA.

4.2.7.2 Staff Evaluation

<INSERT Supplemental Information, to be provided by Tech Staff (EMCB-A/Elliot)

4.2.7.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of RPV axial weld failure probability in Section A3.1 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the RPV axial weld failure probability is adequate.

4.2.7.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), regarding the RPV axial weld failure probability, that the analyses have been projected to the end of the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.3 Metal Fatigue of the RPV and Internals, and Reactor Coolant PressureBoundary Piping and Components

A cyclically loaded metal component may fail because of fatigue even though the cyclic stresses are considerably less than the static design limit. Some design codes such as the ASME Boiler and Pressure Vessel Code and the ANSI piping codes contain explicit metal fatigue calculations or design limits. Cyclic or fatigue design of other components may not be to these codes, but may use similar methods. These analyses, calculations and designs to cycle count limits or to fatigue usage factor limits may be TLAAs.

4.3.1 RPV Fatigue Analyses

4.3.1.1 Summary of Technical Information in the Application

In LRA Section 4.3.1, the applicant summarized the evaluation of the RPV fatigue analyses for the period of extended operation. RPV fatigue analyses were performed for the vessel support skirt, shell, upper and lower heads, closure flanges, nozzles and penetrations, nozzle safe ends, and closure studs. The end-of-40-year license fatigue usage was determined for the normal and upset pressure and thermal cycle events. Subsequent to the original stress analyses, several hardware changes, operational changes (such as the 1998 power rerate), and/or stress analysis revisions have affected the usage factors. Calculation of fatigue usage factors is part of the current licensing basis and is used to support safety determinations. The RPV fatigue analyses are TLAAs.

4.3.1.2 Staff Evaluation

<INSERT Supplemental Information, to be provided by Tech Staff (EMEB-B/Fair)>

4.3.1.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of RPV fatigue analyses in Section A3.2 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the RPV fatigue analyses is adequate.

4.3.1.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), regarding the RPV fatigue analyses, that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation; and pursuant to 10 CFR 54.21(c)(1)(ii), that the analyses have been projected to the end of the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.3.2 Fatigue Analysis of RPV Internals

4.3.2.1 Summary of Technical Information in the Application

In LRA Section 4.3.2, the applicant summarized the evaluation of the fatigue analysis of RPV internals for the period of extended operation. Fatigue analysis of the RPV internals was performed using the ASME Boiler and Pressure Vessel Code, Section III, as a guide. The most significant fatigue loading occurs at the jet pump diffuser to baffle plate weld location. The original 40-year calculation showed a CUF of ~0.33, less than the ASME allowable of 1.0. Because this analysis used a number of cycles for a 40-year life, it is a TLAA.

4.3.2.2 Staff Evaluation

<INSERT Supplemental Information, to be provided by Tech Staff (EMEB-B/Fair)>

4.3.2.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of fatigue analysis of RPV internals in Section A3.2 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the fatigue analysis of RPV internals is adequate.

4.3.2.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), regarding the fatigue analysis of RPV internals, that the analyses have been projected to the end of the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.3.3 ASME Section III Class 1 Reactor Coolant Pressure Boundary (RCPB) Piping and Fatigue Analysis

4.3.3.1 Summary of Technical Information in the Application

In LRA Section 4.3.3, the applicant summarized the evaluation of the ASME Section III Class 1 reactor coolant pressure boundary (RCPB) piping and fatigue analysis for the period of extended operation. MNGP piping systems were originally designed in accordance with ASA B31.1 and USAS B31.1.0 which did not require that an explicit fatigue analysis be performed. Reconciliation for the use of later editions of construction codes for modification to or replacement of piping and components has been performed in accordance with Section IWA-7210(c), Section XI of the ASME Code. The governing code for design, materials, fabrication and erection of piping, piping components, and pipe support modifications or replacements is ANSI B31.1, 1977 Edition including Addenda up to and including the Winter of 1978. Portions of Class 1 systems such as the reactor recirculation, core spray and RHR inside drywell were required to be analyzed for fatigue in accordance with the ASME Code Section III for Nuclear Class 1 piping. The implementation of these requirements at MNGP were for the purpose of attaining a higher quality level and provide more detailed analysis to confirm protection of the reactor coolant system integrity. The analyses demonstrate that the 40 year cumulative usage factors (CUF) for the limiting components in all affected systems are below the ASME Code Section III allowable value of 1.0. Because these analyses are based on cycles postulated to occur in the current 40 year design life, they are TLAAs.

4.3.3.2 Staff Evaluation

<INSERT Supplemental Information, to be provided by Tech Staff (EMEB-B/Fair)>

4.3.3.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of ASME Section III Class 1 RCPB piping and fatigue analysis in Section A3.2 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the ASME Section III Class 1 RCPB piping and fatigue analysis is adequate.

4.3.3.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), regarding the ASME Section III Class 1 RCPB piping and fatigue analysis, that the analyses remain valid for the period of extended operation; and 10 CFR 54.21(c)(1)(iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.3.4 RCPB Section III Class 2 and 3, Piping and Components

4.3.4.1 Summary of Technical Information in the Application

In LRA Section 4.3.4, the applicant summarized the evaluation of the RCPB Section III Class 2 and 3, piping and components for the period of extended operation. MNGP piping systems were originally designed in accordance with ASA B31.1 and USAS B31.1.0 which did not require that an explicit fatigue analysis be performed. Reconciliation for the use of later editions of construction codes for modification to or replacement of piping and components has been performed in accordance with Section IWA-7210(c), Section XI of the ASME Code. The governing code for design, materials, fabrication and erection of piping, piping components, and pipe support modifications or replacements is ANSI B31.1, 1977 Edition including Addenda up to and including the Winter of 1978. The codes and standards to which MNGP was designed and constructed did not include fatigue analyses for piping, component supports or component connections and anchors. The only exceptions are some ASME Class MC containment piping support and penetration analyses for "New Loads" (Section 4.6), and RCPB piping discussed in the preceding section.

4.3.4.2 Staff Evaluation

<INSERT Supplemental Information, to be provided by Tech Staff (EMEB-B/Fair)>

4.3.4.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of RCPB Section III Class 2 and 3, piping and components in Section A3.4 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the RCPB Section III Class 2 and 3, piping and components is adequate.

4.3.4.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), regarding the RCPB Section III Class 2 and 3, piping and components, that the analyses remain valid for the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.4 Irradiation Assisted Stress Corrosion Cracking (IASCC)

4.4.1 Summary of Technical Information in the Application

In LRA Section 4.4, the applicant summarized the evaluation of irradiation assisted stress corrosion cracking (IASCC) for the period of extended operation. Austenitic stainless steel RPV internal components exposed to a neutron fluence greater than 5×10^{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.

4.4.2 Staff Evaluation

The staff reviewed the information in the LRA and noted that the austenitic stainless steel components that are exposed to a neutron fluence greater than 5×10^{20} n/cm^2 (E >1 MeV) are

considered susceptible to IASCC. These RPV internal components include the top guide, the shroud, and the incore instrumentation dry tubes and guide tubes. The staff 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 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 AMPs 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 staff 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 staff 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 staff 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 staff also observed that the NRC SER (ML011570460) that accepted BWRVIP-41 stated that materials in a 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 staff 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 staff 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 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 staff 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 staff 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 staff asked the applicant to clarify the purpose of this added factor. The applicant stated that this factor was added for conservatism.

The staff reviewed the RPV 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 staff 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 staff 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. **In response to the RAI, the applicant stated that...**

4.4.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of IASCC in Section A3.5 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the IASCC is adequate.

4.4.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), regarding the IASCC, that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.5 Effects of Reactor Coolant Environment

4.5.1 Summary of Technical Information in the Application

In LRA Section 4.5, the applicant summarized the evaluation of the effects of reactor coolant environment for the period of extended operation. GSI-190 was identified by the NRC because of concerns about the effects of reactor water environments on the fatigue life of components and piping during the period of extended operation. GSI-190 was closed in December of 1999, and concluded that environmental effects have a negligible impact on core damage frequency, and as such, no generic regulatory action is required. However, as part of the closure of GSI-190, the NRC concluded that licensees who apply for license renewal should address the effects of coolant environment on component fatigue life as part of their aging management

programs. Fatigue calculations that include consideration of environmental effects to establish cumulative usage factors can be treated as TLAAs under 10 CFR Part 54 or they could be used to establish the need for an aging management program. To qualify as a TLAA, the analysis must satisfy all six criteria defined in 10 CFR 54.3. Failure to satisfy any one of these criteria eliminates the analysis from further consideration as a TLAA. Fatigue design for MNGP has been determined to be a TLAA, even though the design limits are based on cycles rather than an explicit time period. Reactor water environmental effects, however, are not included in the MNGP current licensing basis (CLB). Consequently, the criterion of 10 CFR 54.3(a)(6) is not satisfied. Nevertheless, environmental effects on Class 1 component fatigue have been evaluated separately to determine if any additional actions are required for the extended period of operation.

4.5.2 Staff Evaluation

<INSERT supplemental information, to be provided by Tech Staff (EMEB-B/Fair)>

4.5.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of effects of reactor coolant environment in Section A3.7 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the effects of reactor coolant environment is adequate.

4.5.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), regarding the effects of reactor coolant environment, that the analyses have been projected to the end of the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.6 Fatigue Analyses of the Primary Containment, Attached Piping, and Components

The MNGP primary containment was designed in accordance with the ASME Code, Section III, 1965 Edition with addenda up to and including Winter of 1965. Subsequently, during large scale testing for the Mark III containment system and the in-plant testing for Mark I primary containment systems, new suppression chamber hydrodynamic loads were identified. These new loads are related to the LOCA scenario and SRV operation.

4.6.1 Fatigue Analysis of the Suppression Chamber, Vents, and Downcomers

4.6.1.1 Summary of Technical Information in the Application

In LRA Section 4.6.1, the applicant summarized the evaluation of the fatigue analysis of the suppression chamber, vents, and downcomers for the period of extended operation. New hydrodynamic loads were identified subsequent to the original design for the containment suppression chamber vents. These loads result from blowdown into the suppression chamber

during a postulated LOCA and during SRV operation for plant transients. The results of analyses of these effects are presented in the MNGP USAR. Consequently, these analyses are TLAAs.

4.6.1.2 Staff Evaluation

<INSERT Supplemental Information, to be provided by Tech Staff (EMEB-B/Fair)>

4.6.1.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of fatigue analysis of the suppression chamber, vents, and downcomers in Section A3.8 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the fatigue analysis of the suppression chamber, vents, and downcomers is adequate.

4.6.1.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), regarding the fatigue analysis of the suppression chamber, vents, and downcomers, that the analyses remain valid for the period of extended operation; and pursuant to 10 CFR 54.21(c)(1) (iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.6.2 Fatigue Analysis of the SRV Piping Inside the Suppression Chamber and Internal Structures

4.6.2.1 Summary of Technical Information in the Application

The reactor pressure relief system includes SRVs located on the main steam lines within the drywell between the reactor vessel and the first isolation valve. The SRVs, which discharge to the suppression pool, provide two main protective functions: (1) overpressure relief - the valves open to limit the pressure rise in the reactor and (2) depressurization - the valves are opened to depressurize the reactor. The Plant Unique Analysis Report (PUAR) describes the fatigue analysis of the SRV discharge lines. These analyses assume a limited number of SRV actuations throughout the 40 year life of MNGP and are therefore TLAAs. Torus internal structures (i.e., catwalk and monorail) are service level E structures. Consequently, no fatigue evaluation is required to demonstrate acceptability of these structures.

4.6.2.2 Staff Evaluation

<INSERT Supplemental Information, to be provided by Tech Staff (EMEB-B/Fair)>

4.6.2.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of fatigue analysis of the SRV piping inside the suppression chamber and internal structures in Section A3.8 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the fatigue analysis of the SRV piping inside the suppression chamber and internal structures is adequate.

4.6.2.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), regarding the fatigue analysis of the SRV piping inside the suppression chamber and internal structures, that the analyses remain valid for the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.6.3 Fatigue Analysis of Suppression Chamber External Piping and Penetrations

4.6.3.1 Summary of Technical Information in the Application

In LRA Section 4.6.3, the applicant summarized the evaluation of the fatigue analysis of suppression chamber external piping and penetrations for the period of extended operation. These analyses include the large and small bore torus attached piping (TAP), suppression chamber penetrations and the ECCS suction header. Fatigue analyses were completed that were based on cycles postulated to occur within the 40 year operating life of the plant. Therefore these calculations are TLAAs.

4.6.3.2 Staff Evaluation

<INSERT Supplemental Information, to be provided by Tech Staff (EMEB-B/Fair)>

4.6.3.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of fatigue analysis of suppression chamber external piping and penetrations in Section A3.8 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the fatigue analysis of suppression chamber external piping and penetrations is adequate.

4.6.3.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), regarding the fatigue analysis of suppression chamber external piping and penetrations, that the analyses remain valid for the period of extended operation; and pursuant to 10 CFR 54.21(c)(1) (iii), that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the

USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.6.4 Drywell-to-Suppression Chamber Vent Line Bellows Fatigue Analysis

4.6.4.1 Summary of Technical Information in the Application

In LRA Section 4.6.4, the applicant summarized the evaluation of the drywell-to-suppression chamber vent line bellows fatigue analysis for the period of extended operation. The drywell-to-suppression chamber vent line bellows are included in the Mark I containment long term program plant-unique analysis. A fatigue analysis of the vent line bellows demonstrates their adequacy to accommodate thermal and internal pressure load cycles for the life of the plant. As such this analysis is a TLAA.

4.6.4.2 Staff Evaluation

<INSERT Supplemental Information, to be provided by Tech Staff (EMEB-B/Fair)>

4.6.4.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of drywell-to-suppression chamber vent line bellows fatigue analysis in Section A3.8 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the drywell-to-suppression chamber vent line bellows fatigue analysis is adequate.

4.6.4.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), regarding the drywell-to-suppression chamber vent line bellows fatigue analysis, that the analyses remain valid for the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.6.5 Primary Containment Process Penetration Bellows Fatigue Analysis

4.6.5.1 Summary of Technical Information in the Application

In LRA Section 4.6.5, the applicant summarized the evaluation of the primary containment process penetration bellows fatigue analysis for the period of extended operation. Containment pipe penetrations that are required to accommodate thermal movement have expansion bellows. The bellows are designed for a minimum number of operating cycles over the design life of the plant. Consequently, the primary containment process penetrations bellows cycle basis is a TLAA.

4.6.5.2 Staff Evaluation

<INSERT Supplemental Information, to be provided by Tech Staff (EMEB-B/Fair)>

4.6.5.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of primary containment process penetration bellows fatigue analysis in Section A3.8 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the primary containment process penetration bellows fatigue analysis is adequate.

4.6.5.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), regarding the primary containment process penetration bellows fatigue analysis, that the analyses remain valid for the period of extended operation. The staff also concluded that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.7 Environmental Qualification of Electrical Equipment (EQ)

4.7.1 Summary of Technical Information in the Application

The 10 CFR 50.49 environmental qualification (EQ) program has been identified as a time-limited aging analysis (TLAA) for the purposes of license renewal. The TLAA of EQ electrical components includes all long-lived, passive electrical components and instrumentation and controls (I&C) components that are important to safety and located in a harsh environment. The harsh environments of the plant are those areas that are subjected to environmental effects by a loss-of-coolant accident (LOCA) or a high-energy line break (HELB). The EQ equipment comprises safety-related and Q-list equipment; nonsafety-related equipment, the failure of which could prevent satisfactory accomplishment of any safety-related function; and necessary post-accident monitoring equipment.

4.7.2 Staff Evaluation

<INSERT supplemental information, to be provided by Tech Staff (EEIB/Knox)>

4.7.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of environmental qualification of electrical equipment in Section A3.9 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the environmental qualification of electrical equipment is adequate.

4.7.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(iii), regarding the environmental qualification of electrical equipment, that the effects of aging on the intended function(s) will be adequately managed for the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.8 Stress Relaxation of Rim Holddown Bolts

4.8.1 Summary of Technical Information in the Application

In LRA Section 4.8, the applicant summarized the evaluation of the stress relaxation of rim holddown bolts for the period of extended operation. As described in the SER to BWRVIP-25, plants must consider relaxation of the rim holddown bolts as a TLAA issue. Because MNGP has not installed core plate wedges, the loss of preload must be considered in the TLAA evaluation.

4.8.2 Staff Evaluation

<INSERT supplemental information, to be provided by Tech Staff (EMCB-A/Elliot)>

4.8.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of stress relaxation of rim holddown bolts in Section A3.6 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the stress relaxation of rim holddown bolts is adequate.

4.8.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(ii), regarding the stress relaxation of rim holddown bolts, that the analyses have been projected to the end of the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.9 Reactor Building Crane Load Cycles

4.9.1 Summary of Technical Information in the Application

In LRA Section 4.9, the applicant summarized the evaluation of the reactor building crane load cycles for the period of extended operation. The MNGP reactor building crane system consists of an 85 ton bridge crane. The crane is capable of handling the drywell head, reactor vessel head, pool plugs and spent fuel pool shipping cask. A refueling service platform, with necessary handling and grappling fixtures services the refueling area and the spent fuel pool. The reactor building crane system has been modified to incorporate redundant safety features

which were not a part of the original design. The modification consists of a new trolley with redundant design features and a capacity of 85 tons on the main hook with redundancy features and an auxiliary 5 ton capacity hook. This modification was implemented for handling heavy loads both during refueling operations and during operations involving the off site shipment of spent fuel. Such offsite shipments of fuel can take place either when the plant is operating or shut down. The redundant crane has been installed to reduce the probability of a heavy load drop to the category of an incredible event. NUREG-0612 suggests that cranes should be designed to meet the applicable criteria and guidelines of Chapter 2-1 of ANSI B30.2-1976, Overhead and Gantry Cranes, and of Crane Manufactures Association of America (CMAA)-70, Specifications for Electric Overhead Traveling Cranes. The reactor building crane, manufactured prior to the issuance of CMAA-70 and ANSI B30.2, was designed to meet EOCI 61. Since the evaluation used as a basis, an expected number of load cycles over the 40-year life of the plant reactor building crane load cycles are a TLAA.

4.9.2 Staff Evaluation

<INSERT supplemental information, to be provided by Tech Staff (EMEB-B/Rajan)>

4.9.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of reactor building crane load cycles in Section A3.10 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the reactor building crane load cycles is adequate.

4.9.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), regarding the reactor building crane load cycles, that the analyses remain valid for the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

4.10 Fatigue Analyses of HPCI & RCIC Turbine Exhaust Penetrations

4.10.1 Summary of Technical Information in the Application

In LRA Section 4.10, the applicant summarized the evaluation of the fatigue analyses of HPCI & RCIC turbine exhaust penetrations for the period of extended operation. To evaluate the effects of testing the operability and performance of the turbine-pump units on a periodic basis, MNGP conducted a detailed evaluation of the thermal cycles experienced during testing. Since the number of cycles used in the evaluation is based on a 40 year plant life this is a TLAA.

4.10.2 Staff Evaluation

<INSERT supplemental information, to be provided by Tech Staff (EMEB-B/Fair)>

4.10.3 USAR Supplement

The applicant provided a USAR supplement summary description of its TLAA evaluation of fatigue analyses of HPCI & RCIC turbine exhaust penetrations in Section A3.11 of LRA Appendix A. On the basis of its review of the USAR supplement, the staff concluded that the summary description of the applicant's actions to address the fatigue analyses of HPCI & RCIC turbine exhaust penetrations is adequate.

4.10.4 Conclusion

The staff concluded that the applicant has provided an acceptable demonstration, pursuant to 10 CFR 54.21(c)(1)(i), regarding the fatigue analyses of HPCI & RCIC turbine exhaust penetrations, that the analyses remain valid for the period of extended operation. The staff also concludes that the USAR supplement contains an appropriate summary description of this TLAA evaluation, sufficient to satisfy the requirements of 10 CFR 54.21(d).

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