APPENDIX A

USAR SUPPLEMENT

APPENDIX A
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A1 APPENDIX A INTRODUCTION

The application for a renewed operating license is required by 10 CFR 54.21(d) to include an Updated Safety Analysis Report (USAR) Supplement. This appendix provides the required supplement for the Monticello Nuclear Generating Plant (MNGP) USAR.

Section A2 of this appendix contains a summary description of the programs for managing the effects of aging during the period of extended operation. Section A3 contains a summary of the evaluation of time-limited aging analyses (TLAAs) for the period of extended operation. Section A4 contains summaries of TLAA supporting activities.

The information in Sections A2, A3, and A4 will be incorporated into the MNGP USAR following receipt of the extended license in accordance with 10 CFR 50.71(e). Other changes to specific sections of the MNGP USAR based on the results of analyses performed in conjunction with the License Renewal Program and the NRC Safety Evaluation Report for MNGP License Renewal will also be made at that time.

A2 PROGRAMS THAT MANAGE THE EFFECTS OF AGING

This section provides summaries of the programs and activities, in alphabetical order, credited for managing the effects of aging. These aging management programs may not exist as discrete programs at MNGP. In many cases they exist as a compilation of various implementing documents that, when taken as a whole, satisfy the intent of NUREG-1800 and/or NUREG-1801 attributes.

The MNGP Quality Assurance Program (USAR Appendix C) implements the requirements of 10 CFR 50, Appendix B, and is consistent with the summary in Appendix A.2 of NUREG-1800, Standard Review Plan for the Review of License Renewal Applications for Nuclear Power Plants, published July 2001. The elements of corrective action, confirmation process, and administrative controls in the Quality Assurance Program are applicable to both safety related and non-safety related systems, structures, and components that are subject to an aging management review.

A2.1 Aging Management Programs

A2.1.1 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. This risk and performance based approach to testing provides reasonable assurance that developing leakage is detected and corrected well before it reaches a magnitude that could compromise containment function.

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.

A2.1.2 **ASME Section XI In-Service 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, Rev. 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 (TAC NO. MB3819).

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

The Plant Chemistry Program augments this program where applicable.

A2.1.3 **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.

A2.1.4 Bolting Integrity

The Bolting Integrity Program manages the aging affects 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:

- 10 CFR 50, Appendix J,
- ASME Section XI In-Service Inspection, Subsections IWB, IWC and IWD,
- Primary Containment In-Service Inspection,
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems,
- ASME Section XI, Subsection IWF,
- Buried Piping and Tanks Inspection,
- Bus Duct Inspection,
- BWR Vessel Internals,
- Reactor Head Closure Studs Monitoring,
- System Condition Monitoring, and
- Structures Monitoring.

A2.1.5 Buried Piping & Tanks Inspection

The buried piping and tanks inspection program consists of preventive and condition monitoring measures to manage the aging effects for buried piping, conduit and tanks in scope for license renewal. Buried components in scope for license renewal include carbon steel piping, bolting, conduit and tanks (loss of material due to general, crevice, galvanic, MIC and pitting corrosion) and cast iron piping (loss of material due to general, crevice, galvanic, MIC and pitting corrosion and selective leaching). Preventive measures consist of protective coatings and/or wraps on buried components. Condition monitoring consists of periodic inspections of buried components.

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

A2.1.6 **Bus Duct Inspection Program**

The purpose of this aging management program is to demonstrate, for in-scope non-segregated bus ducts, 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 so that there is reasonable assurance that the non-segregated bus ducts will perform their intended function in accordance with the current licensing basis during the period of extended operation. The intended function of non-segregated bus ducts is to provide electrical connections to specified sections of an electrical circuit to deliver voltage, current or signals.

Industry operating experience indicates that the failure of bus ducts is caused by the cracking of bus bar insulation (bus sleeving) combined with the accumulation of moisture or debris. Cracked insulation in the presence of moisture or debris provides phase-to-phase or phase-to-ground electrical tracking paths, which can result in catastrophic failure of the buses.

Bus ducts exposed to appreciable ohmic heating during operation may experience loosening of bolted connections because of the repeated cycling of connected loads. This phenomenon can occur in heavily loaded circuits, i.e., those exposed to appreciable ohmic heating. Sandia 96-0344 identified instances of bolted connection loosening at several plants due to thermal cycling. NRC Information Notice 2000-14 identified torque relaxation of splice plate connecting bolts as one potential cause of a bus duct fault.

The primary objective of the aging management program is to provide an inspection of bus ducts. 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.

The purpose of the aging management program is to provide reasonable assurance that the intended functions of nonsegregated bus ducts that are not subject to the environmental qualification requirements of 10 CFR 50.49 and are exposed to adverse localized environments caused by the ingress of moisture, 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 maintained consistent with the current licensing basis through the period of extended operation. This program considers the technical information provided in Information Notice No. 89-64.

A2.1.7 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.

A2.1.8 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.

A2.1.9 **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 (with approved ISI Relief Requests) 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.

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.

A2.1.10 **BWR Stress Corrosion Cracking**

The Monticello Nuclear Generating Plant BWR Stress Corrosion Cracking Program is an existing program and is part of the MNGP ASME Section XI In-Service Inspection Program. 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.

A2.1.11 **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. BWRVIP-130 supersedes previous revisions of the guidelines, including BWRVIP-29 (TR-103515, 1993 Revision) for water chemistry in BWRs. This is considered an exception to the NUREG-1801 Program Description.

The Program is updated periodically as required by 10 CFR 50.55a. In addition the Program is supplemented by implementing the guidelines of Boiling Water Reactor Vessel and Internals Project (BWRVIP) documents.

A2.1.12 **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 and approved ISI Relief Requests. 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 (TR-1008192) BWR Water Chemistry Guidelines - 2004 Revision. BWRVIP-130 supersedes previous revisions of the guidelines, including BWRVIP-29 (TR-103515, 1993 Revision) for water chemistry in BWRS.

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

A2.1.13 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. 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. A review of plant operating experience demonstrates these measures ensure closed-cycle cooling water (CCCW) systems are performing their intended functions.

The MNGP has four systems in License Renewal Scope that meet the definition for consideration as closed-cycle cooling water systems and portions of three additional systems (heat exchangers or coolers) that are serviced directly by these cooling water systems. These systems and portions of systems are not subject to significant sources of contamination, in which water chemistry is controlled and 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 but at sufficient intervals to detect the impact of aging effects on component function.

A2.1.14 Compressed Air Monitoring

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.

A2.1.15 Electrical Cables & Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements Program

The MNGP Electrical Cables & Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements Program is a new program that manages 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. 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.

As stated in NUREG/CR-5643, “The major concern with cables is the performance of aged cable when it is exposed to accident conditions.” The statement of considerations for the final license renewal rule (60 Fed. Reg. 22477) states, “The major concern is that failures of deteriorated cable systems (cables, connections, and penetrations) might be induced during accident conditions.” 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.

The program provides reasonable assurance that the intended functions of electrical cables and connections within scope of license renewal that are not subject to the environmental qualification requirements of 10 CFR 50.49 and are exposed to adverse localized environments caused by heat, radiation, or moisture are maintained consistent with the current licensing basis through the period of extended operation. This program considers the technical information and guidance provided in NUREG/CR-5643, IEEE Std. P1205-2000, SAND96-0344, and EPRI TR-109619.

The program addresses cables and connections whose configuration is such that most cables and connections installed in adverse localized environments are accessible. This program is a sampling program in which selected cables and connections from accessible areas are inspected and represent, with reasonable assurance, all cables and connections in the adverse localized environments. If an unacceptable condition or situation is identified for a cable or connection in the inspection sample, a determination is made as to whether the same condition or situation is applicable to other accessible or inaccessible cables or connections.

A2.1.16 Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrument 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.

In most areas within a nuclear power 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. Conductor insulation materials used in electrical cables may degrade more rapidly than expected in these adverse localized environments. An adverse localized environment is a condition in a limited plant area that is significantly more severe than the specified service environment for the cable. 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.

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.

The purpose of the aging management program is to provide reasonable assurance that the intended functions of electrical cables that are not subject to the environmental qualification requirements of 10 CFR 50.49 and are used in circuits with sensitive, low-level signals exposed to adverse localized environments caused by heat, radiation or moisture will be maintained consistent with the current licensing basis through the period of extended operation. This program considers the technical information and guidance provided in NUREG/CR-5643, IEEE Std. P1205, SAND96-0344, and EPRI TR-109619.

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, NMC will perform cable system testing. A proven cable system test for detecting deterioration of the insulation system (such as insulation resistance tests, time domain reflectometry test, or other testing judged to be effective in determining cable insulation condition) will be performed.

As stated in NUREG/CR-5643, “The major concern with cables is the performance of aged cable when it is exposed to accident conditions.” The statement of considerations for the final license renewal rule (60 Fed. Reg. 22477) states, “The major concern is that failures of deteriorated cable systems (cables, connections, and penetrations) might be induced during accident conditions.” Since they are not subject to the environmental qualification requirements of 10 CFR 50.49, the electrical cables 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.

A2.1.17 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 included periodic inspection and testing of the cable spreading room halon fire suppression system.

A2.1.18 **Fire Water System**

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. The system is also normally maintained at required operating pressure and is monitored such that loss of system pressure is immediately detected and corrective actions initiated.

A2.1.19 **Flow-Accelerated Corrosion**

The Flow-Accelerated Corrosion Program manages aging effects (loss of material) due to flow-accelerated corrosion (FAC) on the internal surfaces of carbon or low alloy steel piping, elbows, reducers, expanders, and valve bodies 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; (c) follow-up inspections to confirm the predictions; and (d) repairing or replacing components, as necessary.

The MNGP Flow-Accelerated Corrosion Program includes the response made to GL 89-08, Erosion/Corrosion Induced Pipe Wall Thinning.

A2.1.20 **Fuel Oil Chemistry**

The Monticello Nuclear Generating Plant (MNGP) 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

A2.1.21 **Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements**

The purpose of this aging management program is to demonstrate that inaccessible, non-EQ medium-voltage cables susceptible to aging effects caused by moisture and voltage stress will be adequately managed so that there is reasonable assurance that the cables will perform their intended function in accordance with the current licensing basis during the period of extended operation. 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 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.

A2.1.22 **Inspection of Overhead Heavy Load & 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 in-scope load handling components. Functional tests are also performed to assure their integrity. The cranes also comply with the maintenance rule requirements provided in 10 CFR 50.65.

A2.1.23 One-Time Inspection

The MNGP One-Time Inspection Program is a new program that is being developed consistent with NUREG-1801 Chapter XI Program M32, “One-Time Inspection.” Any exceptions or enhancements to NUREG-1801 will be described in the relevant element descriptions. This program includes measures to verify the effectiveness of the following aging management programs:

- Plant Chemistry Program
- Fuel Oil Chemistry Program

This program also confirms the absence of age degradation in selected components (e.g., flow restrictors, venturis, and small bore piping) within License Renewal scope.

The MNGP One-Time Inspection Program addresses concerns and confirmation for the potential long incubation period for certain aging effects on structures and components. There are cases where either (a) an aging effect is not expected to occur but there is insufficient data to completely rule it out, or (b) an aging effect is expected to progress very slowly.

The activities of the One-Time Inspection Program include (a) determination of the sample size based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience; (b) identification of the inspection locations in the system or component based on the aging effect; (c) determination of the examination technique, including acceptance criteria that would be effective in managing the aging effect for which the component is examined; and (d) evaluation of the need for follow-up examinations to monitor the progression of any identified aging degradation.

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

A2.1.24 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.

A2.1.25 Plant Chemistry Program

The MNGP Plant Chemistry Program mitigates the aging effects on component surfaces that are exposed to water as the process fluid; chemistry programs are used to control water chemistry for impurities (e.g., chloride and sulfate) that accelerate corrosion or crack initiation and growth and that cause heat transfer degradation due to fouling in select heat exchangers. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below system-specific limits based on BWRVIP-130 (EPRI TR-1008192): BWR Water Chemistry Guidelines - 2004 Revision. BWRVIP-130 supersedes previous revisions of the BWR Water Chemistry Guidelines including BWRVIP-29 (TR-103515, 1993 Revision).

For low-flow or stagnant portions of a system, a one-time inspection of selected components at susceptible locations provides verification of the effectiveness of the Plant Chemistry Program.

A2.1.26 Primary Containment In-Service Inspection Program

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 program conforms to the applicable requirements of 10CFR50.55a and the 1992 Edition with 1992 Addenda of the ASME Boiler and Pressure Vessel Code, Subsection IWE.

A detailed VT-3 and VT-1 examination is performed once during each 10-year 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 CFR50.55a.

A2.1.27 Protective Coating Monitoring & Maintenance Program

The MNGP Protective Coating Monitoring and Maintenance Program applies to Service Level 1 protective coatings inside containment to address the concerns of NRC GL 98-04, Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System after a Loss-of-Cooling Accident because of Construction and Protective Coating Deficiencies and Foreign Material in Containment. The Protective Coating Monitoring and Maintenance Program prevents the degradation of coatings that could lead to the clogging of ECCS suppression pool suction strainers. MNGP does not credit the Protective Coating Monitoring and Maintenance Program for the prevention of corrosion of carbon steel components.

As outlined in MNGP's response to GL 98-04, the Protective Coating Monitoring and Maintenance Program is a comparable program for monitoring and maintaining protective coatings inside the primary containment and subject to the requirements of ANSI N101.4-1972, to the extent specified in ANSI N18.7-1976 and as modified by Regulatory Guide 1.54, June 1973.

A2.1.28 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 50.55.a.

A2.1.29 Reactor Vessel Surveillance

The MNGP Reactor Vessel Surveillance Program is part of the Boiling Water Reactor’s 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 NUREG-1801.

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.

A2.1.30 **Selective Leaching of Materials**

The MNGP Selective Leaching of Materials Program will be a new program, developed and implemented before the start of the period of extended operation. The program 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.

A2.1.31 **Structures Monitoring Program**

The MNGP Structures Monitoring Program provides for aging management of structures and structural components within the scope of license renewal and implements the NUREG-1801, XI.S6, Structures Monitoring Program. The Structures Monitoring Program is based on the guidance provided in RG 1.160 and NUMARC 93-01. The Structures Monitoring Program is implemented as part of the structures monitoring done under the MNGP Maintenance Rule Program and with additional inspections of the intake structure and diesel fuel oil transfer house.

The Structures Monitoring Program also implements the NUREG-1801, XI.S5, Masonry Wall Program. Masonry block wall inspections are performed as part of the maintenance rule inspections and are based on IEB 80-11 with administrative controls per IN 87-67.

As permitted 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 in scope for 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.

A2.1.32 System Condition Monitoring Program

The System Condition Monitoring Program is an existing plant-specific program that 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.

A2.1.33 Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)

The MNGP Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program monitors the aging effects of loss of fracture toughness on the intended function of the component by performing examinations on CASS reactor vessel internal components as part of the MNGP ASME Section XI 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.

A3 EVALUATION OF TIME-LIMITED AGING ANALYSES

As part of a License Renewal Application, 10 CFR 54.21(c) requires that an evaluation of time-limited aging analyses (TLAAs) for the period of extended operation be provided. The following TLAAs have been identified and evaluated to meet this requirement.

Where used herein, the term “rerate” refers to the MNGP Power Rerate Program, which resulted in an increase in rated thermal power from 1670 MWt to 1775 MWt (approximately 6.3 percent). The increase in rated thermal power was implemented at MNGP in 1998. To demonstrate margin, most analyses performed for the power rerate conservatively used a power level of 1880 MWt. The continued use of this conservatism is described, where appropriate, in the following TLAA evaluations.

A3.1 Neutron Embrittlement of the Reactor Pressure 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 (RTNDT), 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 RTNDT and a decrease in the USE of RPV steels. The increase or shift in the initial nil-ductility reference temperature (RT_{NDT}) 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 ΔRT_{NDT} RTNDT values for the licensed operating period along with appropriate margins.

The RPV ΔRT_{NDT} and USE, calculated on the basis of neutron fluence, are part of the licensing basis and support safety determinations. Therefore, these calculations are

Time-Limited Aging Analyses (TLAAs). The increases in RTNDT (ΔRT_{NDT}) affect the bases for relief from circumferential weld inspection and their associated supporting calculation of limiting axial weld conditional failure probability. As such, circumferential weld examination relief and axial weld failure probability are also TLAAs. Section A3.1 includes the following TLAA discussions related to the issue of neutron embrittlement:

- 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 Materials USE Reduction Due to Neutron Embrittlement

Summary Description

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 for all other materials (Reference 1). 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) (Reference 2). As such, these calculations are a TLAA.

Analysis

The MNGP RPV was designed for a 40-year life with an assumed neutron exposure of less than 10^{19} n/cm^2 from energies exceeding 1 MeV. The current licensing basis calculations use realistic calculated fluences that are lower than this limiting value. The design basis value of 10^{19} n/cm^2 bounds calculated fluences for the original 40-year term.

The tests performed on RPV materials under the Code of Record provided limited Charpy impact data. It was possible to develop original Charpy impact test USE values for only one plate material using the methods of 10 CFR 50 Appendix H and American Society For Testing and Materials (ASTM) E185 invoked by 10 CFR 50 Appendix G. Therefore, alternative methods approved by the NRC in NEDO-32205-A, have been used to demonstrate compliance with the 40-year 50 ft-lb USE requirement.

Disposition: Revision, 10 CFR 54.21(c)(1)(ii)

Fluence was calculated for the MNGP RPV for the extended 60-year (54 EFPY) licensed operating periods, using the methodology of NEDC-32983P, "General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluation," which was approved by the NRC in a letter dated September 14, 2001 from S.A. Richards (NRC) to J.F. Klapproth (GE) (Reference 3). The NRC found that, in general, this methodology adheres to the guidance in Regulatory Guide 1.190 for neutron flux evaluation. For MNGP, 54 EFPY is equivalent to 3.90×10^8 MWh through the end of Cycle 22 at 1775 MWt plus 4.76E8 MWh at 1880 MWt. Peak fluence was calculated at the RPV inner surface (inner diameter), for purposes of evaluating USE. The value of neutron fluence was also calculated for the 1/4T location into the RPV wall measured radially from the inside diameter (ID), using Equation 3 from Paragraph 1.1 of Regulatory Guide (RG) 1.99, Revision 2. This 1/4T depth is recommended in the ASME Boiler and Pressure Vessel Code Section XI, Appendix G Subarticle G-2120 as the maximum postulated defect depth.

The End of License (EOL) USE was evaluated by an EMA using the 54 EFPY calculated fluence, and MNGP surveillance capsule results. As described in the Safety Evaluation Report (SER) to BWRVIP-74 (Reference 4), the percent reduction in Charpy USE for the limiting BWR/3-6 plates and BWR/2-6 welds are 23.5% and 39% respectively. Table A3.1-1 and Table A3.1-2 provide results of the EMA for limiting welds and plates on the RPV. The results show that the limiting USE EMA percent is less than the BWRVIP-74 EMA percent acceptance criterion in all cases, and is therefore acceptable. The 54 EFPY USE values are managed in conjunction with surveillance capsule results as part of the BWRVIP Integrated Surveillance Program, BWRVIP-86-A (Reference 5) and BWRVIP-116 (Reference 15).

Table A3.1-1 Equivalent Margin Analysis for MNGP Plate Material

BWR/3-6 PLATE
<u>Surveillance Plate USE:</u> %Cu = 0.17 1st Capsule Fluence = 2.93 x 10^{17} n/cm^2 2nd Capsule Fluence = N/A 1st Capsule Measured % Decrease = N/A (Charpy Curves) 2nd Capsule Measured % Decrease = N/A (Charpy Curves) 1st Capsule RG 1.99 Predicted % Decrease = 11.5 (RG 1.99, Figure 2) 2nd Capsule RG 1.99 Predicted % Decrease = N/A (RG 1.99, Figure 2)
<u>Limiting Beltline Plate USE:</u> %Cu = 0.17 54 EFPY 1/4T Fluence = 3.82 x 10^{18} n/cm^2 RG 1.99 Predicted % Decrease = 21 (RG 1.99, Figure 2) Adjusted % Decrease = N/A (RG 1.99, Position 2.2)
21 < 23.5%, so vessel plates are bounded by EMA

Table A3.1-2 Equivalent Margin Analysis for MNGP Weld Material

BWR/3-6 WELD
Surveillance Weld USE: %Cu = 0.04 1st Capsule Fluence = 2.93 x 10^{17} n/cm^2 2nd Capsule Fluence = N/A 1st Capsule Measured % Decrease = N/A (Charpy Curves) 2nd Capsule Measured % Decrease = N/A (Charpy Curves) 1st Capsule RG 1.99 Predicted % Decrease = 8 (RG 1.99, Figure 2) 2nd Capsule RG 1.99 Predicted % Decrease = N/A (RG 1.99, Figure 2)
Limiting Beltline Weld USE: %Cu = 0.10 54 EFPY 1/4T Fluence = 3.82 x 10^{18} n/cm^2 RG 1.99 Predicted % Decrease = 19.5 (RG 1.99, Figure 2) Adjusted % Decrease = N/A (RG 1.99, Position 2.2)
19.5 < 39%, so vessel welds are bounded by EMA.

Adjusted Reference Temperature (ART) for RPV Materials Due to Neutron Embrittlement

Summary Description

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. RTNDT 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 (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 (ΔRT_{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} + ΔRT_{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 ΔRT_{NDT} calculations for the licensed operating period. RG 1.99 defines the calculation methods for ΔRT_{NDT}, ART, and end-of-life USE.

The ΔRT_{NDT} and ART calculations meet the criteria of 10 CFR 54.3(a). As such, they are TLAAs.

Analysis

The MNGP RPV was designed for a 40-year life with an assumed neutron exposure of less than 10^{19} n/cm^2 from energies exceeding 1 MeV (Reference 6). The current licensing basis calculations use realistic calculated fluences that are lower than this limiting value. The design basis value of 10^{19} n/cm^2 bounds calculated fluences for the original 40-year term. The ΔRT_{NDT} values were determined using the embrittlement correlations defined in RG 1.99.

Disposition: Revision, 10 CFR 54.21(c)(1)(ii)

Fluence was calculated for the MNGP RPV for the extended 60-year (54 EFPY) licensed operating period, using the methodology of NEDC-32983P, “General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluation,” which was approved by the NRC in a letter dated September 14, 2001 from S.A. Richards (NRC) to J.F. Klapproth (GE) (Reference 3). The NRC found that, in general, this methodology adheres to the guidance in Regulatory Guide 1.190 for neutron flux evaluation. For MNGP, 54 EFPY is equivalent to 3.90×10^8 MWh through the end of Cycle 22 at 1775 MWt plus 4.76×10^8 MWh at 1880 MWt. Peak fluence was calculated at the vessel inner surface (inner diameter), for purposes of evaluating USE and ART. The value of neutron fluence was also calculated for the 1/4T location into the vessel wall measured radially from the inside diameter (ID), using Equation 3 from Paragraph 1.1 of RG 1.99. This 1/4T depth is recommended in the ASME Boiler and Pressure Vessel Code Section XI, Appendix G Sub-article G-2120 as the maximum postulated defect depth.

The 54 EFPY ΔRT_{NDT} for all beltline materials was calculated based on the embrittlement correlation found in RG 1.99. The peak fluence, ΔRT_{NDT}, and ART values for the 60-year (54 EFPY) license operating period are presented in Table A3.1-3. This table shows that the limiting ARTs allow P-T limits that will provide reasonable operational flexibility.

The beltline region is defined as that portion of the RPV adjacent to the active fuel that attains a fluence = 1.0×10^{17} n/cm^2 during plant license. This extends the beltline 18" below and 168" above the bottom of active fuel (approximately 23" above the top of active fuel). As a result, the N2 Recirculation Inlet Nozzle falls within this extended beltline region, and is included in the calculation for ART in Table A3.1-3. The nozzle fluence has been adjusted by a peak/location factor of 0.137. In the absence of copper data for the N2 nozzle, this value is based upon heats of materials used for beltline nozzles at other plants (see Table A3.1-3). The nickel content has been determined as the average from all material test reports for the MNGP N2 nozzles. Additionally, the girth weld between

Shell Rings 2 and 3 falls into the extended beltline region. The limiting weld values presented in Table A3.1-3 represent this girth weld in addition to the other vertical and girth welds in the beltline region.

The MNGP ΔRT_{NDT} and ART values are managed in conjunction with surveillance capsule results from the BWRVIP Integrated Surveillance Program, BWRVIP-86-A (Reference 5) and BWRVIP-116 (Reference 15).

Table A3.1-3 60 Year Analysis Results for MNGP

Lower Shell

Thickness in inches = 5.06	Ratio Peak/Location = 0.659	54 EFPY Peak I.D. fluence = 3.41 x10^{18} n/cm^2
		EFPY Peak 1/4 T Fluence = 2.51 x10^{18} n/cm^2

Lower-Intermediate Shell and All Welds

Thickness in inches = 5.06	Ratio Peak/Location = 1.00	54 EFPY Peak I.D. fluence = 5.17 x10^{18} n/cm^2
		EFPY Peak 1/4 T Fluence = 3.82 x 10^{18} n/cm^2

N2 Nozzle

Thickness in inches = 5.06	Ratio Peak/Location = 0.137	54 EFPY Peak I.D. fluence = 7.08 x10^{17} n/cm^2
		EFPY Peak 1/4 T Fluence = 5.23 x10^{17} n/cm^2

COMPONENT	HEAT	%Cu	%Ni	CF	Initial RT_{NDT} °F	1/4 T Fluence n/cm^2	54 EFPY ΔRT_{NDT} °F	σ_I	σ_Δ	Margin °F	54 EFPY Shift °F	54 EFPY ART °F
PLATES:												
Lower-Intermediate												
1-14 1-15	C2220-1 C2220-2	0.17 0.17	0.65 0.65	131 131	27 27	3.82 x10^{18} 3.82 x10^{18}	96 96	0 0	17 17	34 34	130 130	157 157
Lower												
1-16 1-17	A0946-1 C2193-1	0.14 0.17	0.56 0.50	100 121	27 0	2.51 x10^{18} 2.51 x10^{18}	63 76	0 0	17 17	34 34	97 110	124 110
WELDS:												
Limiting	SMAW	0.10	0.99	138.5	-65.6	3.82 x10^{18}	102	12.7	28	61	163	97
NOZZLES:												
N2*	E21VW	0.18	0.86	141.9	40	5.23 x10^{17}	43	0	17	34	77	117

* In the absence of Cu data for this nozzle, 0.18% is based upon heats of materials used for beltline nozzles at other plants. The mean from nine nozzles (0.119) plus one standard deviation (0.0617) was used to determine the value of 0.18%. CMTR data for the ten (10) MNGP N2 nozzles was averaged to determine the Ni content. CMTR data for the ten (10) MNGP N2 nozzles was used to determine the initial RTNDT.

Reflood Thermal Shock Analysis of the RPV

Summary Description

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.

Analysis

For the current operating period, a thermal shock analysis was originally performed on the RPV components. The analysis assumed a design basis LOCA followed by a low-pressure coolant injection accounting for the full effects of neutron embrittlement at the end of life (40 years). The analysis showed that the total maximum vessel irradiation (1 MeV) at the mid-core inside of the vessel to be 2.4 x 10^{17} n/cm^2 which was below the threshold level of any nil-ductility temperature shift for the vessel material. As a result, it was concluded that the irradiation effects on all locations of the RPV could be ignored. However, this analysis only bounded 40 years of operation.

The peak fluence at the RPV wall for the MNGP RPV is 5.17 x 10^{18} n/cm^2 for 54 EFPY of operation (3.90 x 10^8 MWh through the end of Cycle 22 at 1775 MWt plus 4.76 x 10^8 MWh at 1880 MWt). Based on this fluence value, the previous analysis is not bounding for the period of extended operation. The original analysis has been superseded by an analysis for BWR-6 RPVs (Reference 7) that is applicable to the MNGP BWR3 RPV. The revised analysis is applicable to MNGP as it uses a bounding main steam line break event, and an RPV thickness similar to the MNGP RPV. This analysis assumes end-of-life material toughness, which in turn depends on end-of-life ART. The critical location for fracture mechanics analysis is at ¼ of the RPV thickness (from the inside, 1/4T). For this event, the peak stress intensity occurs at approximately 300 seconds after the LOCA.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

The current analysis (Reference 7) assumes end-of-life material toughness, which in turn depends on end-of-life ART. The critical location for fracture mechanics analysis is at ¼ of the vessel thickness (from the inside, 1/4T). For this event, the peak stress intensity occurs at approximately 300 seconds after the LOCA.

The analysis shows that at 300 seconds into the thermal shock event, the temperature of the vessel wall at 1.5 inches deep (which is 1/4T) is approximately 400°F. For the MNGP vessel, the 1/4T is 1.26 inches. The current analysis is bounding for MNGP for two reasons: (1) the pressure stress (higher for a thinner vessel) is near zero in a thermal shock event, and therefore can be neglected; and (2) the thermal shock event thermal stresses in a 6-inch vessel are greater than those in a 5.06-inch vessel. Figure 3 of (Reference 7) was used to determine the appropriate parameters for the thinner vessel. Figure 3 demonstrates that 300 seconds into the thermal shock event, the temperature of the vessel wall at 1.26 inches deep is approximately 370°F. The ART values tabulated in Table A3.1-3 list the ARTs for the limiting weld metal of the MNGP RPV. The highest calculated RPV beltline material ART value is 157°F. Using the equation for K_{IC} presented in Appendix A of ASME Section XI (Reference 8) and the maximum ART value, the material reaches upper shelf (a K_{IC} value of 200 ksi√in) at 261°F, which is well below the 370°F 1/4T temperature predicted for the thermal shock event at the time of peak stress intensity. Therefore, the revised analysis is valid for the period of extended operation.

Reflood Thermal Shock Analysis of the RPV Core Shroud

Summary Description

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.

Analysis

The RPV core shroud was evaluated for a low-pressure coolant injection reflood thermal shock transient considering the embrittlement effects of 40-year radiation exposure (32 EFPY). The core shroud receives the maximum irradiation on the inside surface opposite the midpoint of the fuel centerline. The total integrated neutron fluence at end of life at the inside surface of the shroud is anticipated to be 2.7 $x10^{20}$ n/cm^2 (greater than 1 MeV). The maximum thermal shock stress in this region will be 155,700 psi equivalent to 0.57% strain. This strain range of 0.57% was calculated at the midpoint of the shroud, the zone of highest neutron irradiation. The calculated strain range of 0.57% represents a considerable margin of safety relative to measured values of percent elongation for annealed Type 304 stainless steel irradiated to 8 x 10^{21} n/cm^2 (greater than 1 MeV). The measured value of percent elongation for stainless steel weld metal is 4% for a temperature of 297°C (567°F) with a neutron fluence of 8 $x10^{21}$ n/cm^2 (greater than 1 MeV), while the average value for base metal at 290°C (554°F) is 20% (Reference 9). Therefore, thermal shock effects on the shroud at the point of highest irradiation level will not jeopardize the proper functioning of the shroud following the design basis accident (DBA) during the current licensed operating period (40 years).

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

As discussed above, core shroud components were evaluated for a reflood thermal shock event, considering the embrittlement effects of lifetime radiation exposure. The analysis includes the most irradiated point on the inner surface of the shroud where the calculated value of fluence for 40-year operating period as below the threshold (3.0 x 10^{20} n/cm^2) for material property changes due to irradiation. However, using the approved fluence methodology discussed above in the section entitled "Adjusted Reference Temperature (ART) for RPV Materials Due to Neutron Embrittlement," the 54 EFPY fluence at the most irradiated point on the core shroud was calculated to be 3.84 x 10^{21} n/cm^2.

Because the measured value of elongation bounds the calculated thermal shock strain amplitude of 0.57%, the calculated thermal shock strain at the most irradiated location is acceptable considering the embrittlement effects for a 60-year operating period.

RPV Thermal Limit Analyses: Operating Pressure - Temperature Limits

Summary Description

The ART is the value of (Initial RT_{NDT} + ΔRT_{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 heat-up / 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.

Analysis

The MNGP Technical Specifications contain P-T limit curves for heat up cooldown, and in-service leakage and hydrostatic testing and also limits the maximum rate of change of reactor coolant temperature. The criticality curves provide limits for both heat up and criticality calculated for a 32 EFPY operating period. The current technical specifications contain P-T curves developed using the 1989 Edition of the ASME Boiler and Pressure Vessel Code, incorporating the effects of the 1998 power rerate and Code Case N-640. The ART remains essentially unchanged (from 156.5^{o}F to 157^{o}F) for the period of extended operation.

Disposition: Revision, 10 CFR 54.21(c)(1)(ii)

NMC manages the P-T curves in conjunction with surveillance capsule results as part of the BWRVIP Integrated Surveillance Program (BWRVIP-86-A (Reference 5) and BWRVIP-116 (Reference 15), respectively).

RPV Circumferential Weld Examination Relief

Summary Description

Relief from RPV circumferential weld examination requirements under Generic Letter (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) (Reference 2). As such, they are a TLAA.

Analysis

MNGP received NRC approval for a technical alternative that eliminated the RPV circumferential shell weld inspections for the current license term. The basis for this relief request was an analysis that satisfied the limiting conditional failure probability for the circumferential welds at the expiration of the current license, based on BWRVIP-05 and the extent of neutron embrittlement. The anticipated changes in metallurgical conditions expected over the extended licensed operating period require an additional analysis for 54 EFPY and approval by the NRC to extend this relief request.

Disposition: Revision, 10 CFR 54.21(c)(1)(ii)

The USNRC evaluation of BWRVIP-05 used the FAVOR code to perform a probabilistic fracture mechanics (PFM) analysis to estimate the RPV shell weld failure probabilities (Reference 10). Three key assumptions of the PFM analysis are: 1) the neutron fluence was the estimated end-of-life mean fluence; 2) the chemistry values are mean values based on vessel types; and 3) the potential for beyond-design-basis events is considered. Table A3.1-4 provides a comparison of the MNGP RPV limiting circumferential weld parameters to those used in the NRC analysis for the first two key assumptions. Data provided in Table A3.1-4 was supplied from Tables 2.6-4 and 2.6-5 of the Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report.

For MNGP, the chemistry values are the same as those used in the NRC analysis, however, the chemistry factor is higher due to an adjustment to reflect the results from two surveillance capsules. The value of fluence is lower than that used in the NRC analysis. As a result, the shift in reference temperature is lower than the 64 EFPY shift from the NRC analysis. In addition, the unirradiated reference temperature is essentially the same. The combination of unirradiated reference temperature ($RT_{NDT}(U)$) and shift (ΔRT_{NDT} w/o margin) yields an ART that is lower than the NRC mean analysis value.

Therefore, the RPV shell weld embrittlement due to fluence has a negligible effect on the probabilities of RPV shell weld failure. The Mean RTNDT value at 54 EFPY is bounded by the 64 EFPY Mean RTNDT provided by the NRC. Although a conditional failure probability has not been calculated, the fact that the MNGP values at the end of license are less than the 64 EFPY value provided by the NRC leads to the conclusion that the MNGP RPV conditional failure probability is bounded by the NRC analysis.

The procedures and training used to limit reactor pressure vessel cold over-pressure events will be the same as those approved by the NRC when MNGP requested approval of the BWRVIP-05 technical alternative for the term of the current operating license. A request for extension for the 60-year extended operating period will be submitted to the NRC prior to the period of extended operation.

Table A3.1-4 Effects of Irradiation on RPV Circumferential Weld Properties for MNGP

Group	CB&I 64 EFPY (Reference 10)	MNGP 54 EFPY
Cu (%)	0.10	0.10
Ni (%)	0.99	0.99
CF	134.9	138.5
Fluence at clad/weld interface (10^{19} n/cm^2)	1.02	0.52
ΔRT_{NDT} w/o margin (°F)	135.6	113
$RT_{NDT(U)}$ (°F)	-65	-65.6
Mean RT_{NDT} (°F)	70.6	47.4
P (F/E) NRC[a]	1.78×10^{-5}	[b]
P (F/E) BWRVIP	-	-

a. P (F/E) stands for “probability of a failure event.”
b. Although a conditional failure probability has not been calculated, the fact that the MNGP values at the end of license are less than the 64 EFPY value provided by the NRC leads to the conclusion that the MNGP RPV conditional failure probability is bounded by the NRC analysis, consistent with the requirements of Reference 10.

RPV Axial Weld Failure Probability

Summary Description

The BWRVIP recommendations for inspection of RPV shell welds (Reference 11) contain generic analyses supporting an NRC SER (Reference 10) 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 above in the section entitled “RPV Circumferential Weld Examination Relief.”

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) (Reference 2). As such, it is a TLAA.

Analysis

As stated above in the section entitled "RPV Circumferential Weld Examination Relief," MNGP received NRC approval for a technical alternative that eliminated the RPV circumferential shell weld inspections for the current license term. The basis for this relief request was an analysis that satisfied the limiting conditional failure probability for the circumferential welds at the expiration of the current license, based on BWRVIP-05 and the extent of neutron embrittlement. The NRC SER associated with BWRVIP-05 (Reference 10) concluded that the RPV failure frequency due to failure of the limiting axial welds in the BWR fleet at the end of 40 years of operation is less than 5×10^{-6} per reactor year. This failure frequency is dependent upon given assumptions of flaw density, distribution, and location. The failure frequency also assumes that "essentially 100%" of the RPV axial welds will be inspected. The anticipated changes in metallurgical conditions expected over the extended licensed operating period require an additional analysis for 54 EFPY and approval by the NRC to extend the RPV circumferential weld inspection relief request.

Disposition: Revision, 10 CFR 54.21(c)(1)(ii)

Table A3.1-5 compares the limiting axial weld 54 EFPY properties for MNGP against the values taken from Table 2.6-5 found in the NRC SER for BWRVIP-05 and associated supplement to the SER (Reference 12). The SER supplement required the limiting axial weld to be compared with data found in Table 3 of the document. For MNGP, the comparison was made to the 'Mod 2' plant information. The supplemental SER stated that the 'Mod 2' calculations most closely match the 5×10^{-6} RPV failure frequency.

For MNGP, the fluence value is greater than that used in the NRC analysis. However, the weld material has a significantly lower copper value (0.10 vs. 0.219 used in the NRC analysis); the nickel values are essentially the same as those used in the NRC analysis. As a result, the value of ΔRT_{NDT} is lower than the NRC analysis. In addition, the unirradiated RT_{NDT} was significantly lower (-65.6°F vs. -2°F used in the NRC analysis). The MNGP limiting weld 54 EFPY Mean RT_{NDT} value is within the limits of the values assumed in the analysis performed by the NRC staff in the March 7, 2000, BWRVIP-05 SER supplement and the 64 EFPY limits and values obtained from Table 2.6.5 of the SER. Therefore, the probability of failure for the axial welds is bounded by the NRC evaluation.

Table A3.1-5 Effects for Irradiation on RPV Axial Weld Properties for MNGP

Value	Mod 2 (Reference 4)	MNGP 54 EFPY
Cu (%)	0.219	0.10
Ni (%)	0.996	0.99
CF		138.5
Fluence x 10^{19} (n/cm^2)	0.148[a]	0.52
ΔRT_{NDT} (°F)	116	113
$RT_{NDT(U)}$ (°F)	-2	-65.6
Mean RT_{NDT} (°F)	114	47.4
P (F/E) NRC	5.02 x 10^{-6}	[b]

a. Peak Axial Fluence
b. Although a conditional failure probability has not been calculated, the fact that the MNGP values at the end of license are less than the Mod 2 value provided by the NRC leads to the conclusion that the MNGP RPV conditional failure probability is bounded by the NRC analysis, consistent with the requirements of Reference 10.

A3.2 Metal Fatigue of the RPV and Internals, and Reactor Coolant Pressure Boundary 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.

Fatigue analyses are presented in the following groupings:

- RPV Fatigue Analyses
- RPV Internals Fatigue Analysis

NUREG-1801 identifies numerous fatigue related aging effects that require evaluation as possible TLAAs in accordance with 10 CFR 54.21(c). Each of these is summarized in NUREG-1800.

RPV Fatigue Analyses

Summary Description

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.

Analysis

The original RPV stress report included a fatigue analysis for the RPV components based on a set of design basis duty cycles. The original 40-year analyses demonstrated that the CUFs for the critical components would remain below the ASME Code Section III allowable value of 1.0.

A reanalysis was performed for RPV CUF values as a part of the 1998 power rerate implementation at MNGP. For power rerate implementation, only components in which the original and power rerate modification stress report CUF values are greater than 0.5 required reanalysis. Subsequent to the original and modification analyses, a fatigue monitoring program was developed and revised fatigue usage values were determined. These fatigue usage values consider actual thermal cycle experience through September 30, 2004. The resulting fatigue CUF values determined for the monitoring program and power rerate supersede the values determined in the original and modification RPV analyses. The current (as of September 30, 2004) and 60-year fatigue usage values are listed in Table A3.2-1.

Table A3.2-1 Fatigue Evaluation Results for Limiting Components

Component	Computed Fatigue Usage Factor (through 9/30/2004)	Computed Fatigue Usage Factor 60-Year License	Monitoring Recommended by NUREG/ CR-6260
Recirculation Outlet Nozzle	0.010	0.015	Yes
Recirculation Inlet Nozzle	0.145	0.220	Yes
Steam Outlet Nozzle	0.124	0.187	No
Feedwater Nozzle	0.328	0.597	Yes
Core Spray Nozzle	0.233	0.645	Yes
Core Support Structure	0.039	0.058	No
Bottom Head and Support Skirt	0.206	0.293	Yes
Control Rod Drive Penetrations	0.179	0.288	No
Vessel Closure Bolts	0.340	0.554	No
Refueling Bellows Skirt	0.502	0.829	No

These results incorporate current fatigue monitoring program cycles accumulated through September 30, 2004. Cycle counting includes those cycles identified in MNGP USAR Table 4.2-1, which identifies the following transient cycles:

MNGP Transient Cycles

Transient Type	No. of Design Cycles (USAR Table 4.2-1)	Projected to 2030
Bolt Up/Unbolt	120	44
Startup/Shutdown @ 100^{o}F/hr	289	207
Scrams	270	165
Design Hydrostatic Test @ 1250 psig	130	67
Reactor Overpressure @ 1375 psig	1	0
Hydrostatic Test to 1560 psig	3	2
Rapid Blowdown	1	0
Liquid Poison Flow @ 80^{o}F	10	0
Feedwater Heater Bypass	70	0
Loss of Feedwater Heater	10	0
Loss of Feedwater Pumps	30	0
Improper Start of Shutdown Recirc Loop	10	8

It should be noted that not all cycles apply to all locations evaluated, and that the number of design cycles identified above represent design values, not the maximum allowable number of transients.

The original code analysis of the reactor vessel included fatigue analysis of the control rod drive hydraulic system return line nozzles. After several years of operation, it was discovered that the control rod drive hydraulic system return line nozzles were subject to cracking caused by a number of factors including rapid thermal cycling (Reference 13). Consequently, the control rod drive hydraulic system return line nozzles were capped and removed from service. As such, they are no longer subject to rapid thermal cycling.

Disposition: Revision and Aging Management, 10 CFR 54.21(c)(1) (ii) and (iii)

For the period of extended operation, the fatigue usage factors for the limiting components have been re-evaluated. No MNGP component exceeded the ASME Code allowable for the 60-year license. The results of the evaluation are shown in Table A3.2-1.

As stated in Chapter IV.A1 of the Generic Aging Lessons Learned (GALL) (NUREG-1801), environmental fatigue issues must be considered for Class 1 components. Chapter 4.3 (Metal Fatigue) of NUREG-1800 states that an aging management program consistent with Chapter X.M1 of the GALL is an acceptable method for management of metal fatigue for the period of extended operation. The current fatigue monitoring program tracks CUFs through cycle-based fatigue (CBF) monitoring.

CBF monitoring consists of a two-step process: (a) cycle counting, and (b) CUF computation based on the counted cycles. The cycle counting counts each transient that is defined in the plant-licensing basis based upon the mechanistic process or sequence of events experienced by the plant as determined from monitored plant instruments. The approach is conservative because it assumes each actual transient has a severity equal to that assumed in the design basis. Transients are identified and implemented into the aging management program. CUF computation calculates fatigue directly from counted transients and parameters for the monitored components. CUF is computed via a design-basis fatigue calculation where the numbers of cycles are substituted for assumed design basis number of cycles.

The current fatigue monitoring program includes 10 components listed in Table A3.2-1. With environmental fatigue considered (see Section A3.7), this program meets the recommendations of Chapter X.M1 of the GALL for the period of extended operation. This is consistent with the components listed in NUREG/CR-6260 (Reference 14), and the recommendations of Chapter X.M1 of the GALL.

Fatigue Analysis of RPV Internals

Summary Description

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 (Reference 6). Because this analysis used a number of cycles for a 40-year life, it is a TLAA.

Analysis

The events analyzed included: (1) Normal startup and shutdown; (2) Improper start of a recirculation loop; and (3) DBA. The fatigue evaluation determined that peak strains occurred as a result of the improper recirculation loop startup transient and the point in the time of the DBA flooding (Low Pressure Coolant Injection (LPCI)) when the shroud and shroud support plate through-wall gradients are at a maximum. None of the other events analyzed contributed significantly to fatigue usage. The 40-year CUF for this location was determined to be ~0.33, i.e., less than the ASME allowable of 1.0.

Disposition: Revision, 10 CFR 54.21(c)(1)(ii)

Because the original fatigue analysis used a number of cycles for a 40-year design life, the calculation was revised for a 60-year life by scaling up the number of cycles by 1.5, except for the DBA transient. The resultant fatigue usage was calculated to be ~0.5, which is less than the ASME Code allowable of 1.0. Therefore, the fatigue usage of the RPV internal components is acceptable for the period of extended operation.

A3.3 ASME Section III Class 1 Reactor Coolant Pressure Boundary (RCPB) Piping Fatigue Analysis

Summary Description

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 I 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 effected 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.

Analysis

With the exception of the torus attached piping and safety relief discharge line piping which were evaluated as part of the Mark I program “New Loads” program, the only piping that has been explicitly analyzed for fatigue are portions of the recirculation system piping, RHR piping, and core spray piping systems. These systems were all modified under the Generic Letter (GL) 88-01 IGSCC inspection and mitigation program.

This piping was originally designed in accordance with USAS B31.1 and modifications were analyzed to ASME Section III Class 1 rules. The ASME Code limit for fatigue is 1.0. The limiting fatigue usages for these systems are shown in Table A3.3-1.

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Table A3.3-1 MNGP Fatigue Monitoring Locations for RCPB Class 1 Piping

Location	40 Year Cumulative Fatigue Usage Factor
Recirculation Equalizer Line Branch Connection	0.8514
RHR Return Loop B Tapered Transition	0.8875
Core Spray Valve Joint	0.6466

For fatigue analyses, the change in stress produced by transients are compared to allowable limits. For a given stress range, the ASME code allows a maximum number of cycles. In a fatigue analysis the actual or design assumed number of cycles is compared to the allowed maximum, and this ratio is summed for all significant transients experienced by the component. The summation, or usage factor, must be less than or equal to 1.0 to be acceptable.

The fatigue analyses for these systems were evaluated using a bounding set of assumed thermal cycles that may occur over the life of the plant (40 years). These conservative evaluations resulted in fatigue usage values that are acceptable (i.e. less than 1.0) however, with the exception of the core spray piping there is not sufficient margin to extrapolate by a ratio of 1.5 with acceptable results.

Cycle based counting consists of periodically counting the relevant cycles and calculating the cumulative usage factor (CUF). This process is also conservative due to the fact that all transients within a group are assumed to be equal in severity and correspond to the maximum cycle thermal limits specified in the design. Based on the number of cycles experienced at MNGP through September 2004, the maximum fatigue usages identified in Table A3.3-1 for the Recirculation and RHR piping systems are expected not to exceed 0.90 at the end of sixty (60) years of plant operation.

Disposition: Validation, 10 CFR 54.21(c)(1)(i) and Aging Management 10 CFR 54.21(c)(1)(iii)

The limiting location for RCPB core spray piping is less than 0.65. Consequently, current analyses are validated for the period of extended operation by:

$$U_{max,40} < 0.65, \times 60/40 = U_{max,60} = 0.975 < 1.0$$

The limiting locations for the recirculation and RHR piping are less than 0.90 taking into account actual cycles accumulated through 2002 and projecting those cycles to 60 years. The MNGP cycle based fatigue monitoring system manages this aging mechanism to ensure that fatigue does not exceed the allowable limit of 1.0.

A3.4 RCPB Section III Class 2 AND 3, ASA B31.1 AND, USAS B31.1 Piping and Components

Summary Description

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 which MNGP was designed and constructed to 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 A3.8), and RCPB piping discussed in the preceding section.

Analysis

Although the code of construction did not invoke fatigue analyses, a stress range reduction factor which is applied to the allowable stress range for expansion stresses is required to account for cyclic thermal conditions. The allowable secondary stress range is 1.0 S_A for 7,000 equivalent full temperature thermal cycles or less and is incrementally reduced to 0.5 SA for greater than 100,000 cycles. With the exception of piping described in Section A3.3 and Section A3.8, MNGP piping analyses incorporated stress range reduction factors for a finite number of thermal cycles in lieu of fatigue analyses.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

An estimate of the number of thermal cycles experienced by these piping systems can be conservatively approximated by the maximum number of thermal cycles used in reactor nozzle fatigue analyses. For MNGP the bounding number of cycles used for the qualification of a vessel nozzle is 1,500 for the feedwater nozzle. The maximum number of cycles projected through the extended period of operation is therefore, 1.5 times 1,500 (2,250). This conservative amount of full range cycles is significantly less than the 7000 cycle limit, consequently existing analyses are valid through the extended term of operation.

A3.5 Irradiation Assisted Stress Corrosion Cracking

Summary Description

Austenitic stainless steel RPV internal components exposed to a neutron fluence greater than 5 x 10^{20} n/cm^2 (E > 1 MeV) are susceptible to irradiation assisted stress corrosion cracking (IASCC) in the BWR environment. As described in the SER to BWRVIP-26, IASCC of RPV internals is a TLAA.

Analysis

Fluence calculations have been performed for the RPV and internals, including the effects of a potential power uprate (1880 MWt). Three components have been identified as being susceptible to IASCC for the period of extended operation: (1) Top Guide, (2) Shroud, and (3) Incore Instrumentation Dry Tubes and Guide Tubes.

Disposition: Aging Management, 10 CFR 54.21(c)(1)(iii)

The top guide, shroud, and incore instrumentation dry tubes and guide tubes are susceptible to IASCC. The aging effect associated with IASCC (crack initiation and growth) will require aging management. All three components (top guide, shroud, and incore instrumentation dry tubes and guide tubes) have been evaluated by the BWRVIP, as described in the Inspection and Evaluation Guidelines for each component: BWRVIP-26 (Top Guide), BWRVIP-76 (Shroud), and BWRVIP-47 (incore instrumentation dry tubes and guide tubes). BWRVIP recommendations are implemented at MNGP by the Water Chemistry and the In-Service Inspection Programs.

A3.6 Stress Relaxation of Rim Holddown Bolts

Summary Description

As described in the SER to BWRVIP-25, plants must consider relaxation of the rim-hold-down bolts as a TLAA issue. Because MNGP has not installed core plate wedges, the loss of preload must be considered in the TLAA evaluation.

Analysis

The core plate hold-down bolts connect the core plate to the core shroud. These bolts are subject to stress relaxation due to thermal and irradiation effects. For the 40-year lifetime, the BWRVIP concluded that all rim hold-down bolts would maintain some preload throughout the life of the plant.

Disposition: Revision 10 CFR 54.21(c)(1)(ii)

For the period of extended operation, the expected loss of preload was assumed to be 19%, which bounds the original BWRVIP analysis. With a loss of 19% in preload, the core plate will maintain sufficient preload to prevent sliding under both normal and accident conditions. Therefore, the loss of preload is acceptable for the period of extended operation.

A3.7 Effects of Reactor Coolant Environment

Summary Description

Generic Safety Issue (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 (6) 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 to determine if any additional actions are required for the extended period of operation.

Analysis

The NRC staff assessed the impact of reactor water environment on fatigue life at high fatigue locations and presented the results in NUREG/CR-6260, “Application of NUREG/CR-5999, Interim Fatigue Curves for Selected Nuclear Power Plant Components,” in March of 1995. Methodology for the determination of environmental correction factors to be applied to the fatigue analyses for carbon and low-alloy steels is contained in NUREG/CR-6583, “Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steels.” Methodology for environmental fatigue factors for austenitic stainless steels is contained in NUREG/CR-5704, “Effects of LWR Coolant Environments on Fatigue Design of Austenitic Stainless Steels.”

As a part of the NRC's Fatigue Action Plan, incorporation of environmental fatigue effects originally involved a reduced set of fatigue design curves, such as those proposed by Argonne National Laboratory (ANL) in NUREG/CR-5999. As a part of the effort to close GSI-166 (later GSI-190) for operating nuclear power plants during the current 40-year licensing term, Idaho National Engineering Laboratory (INEL) evaluated fatigue-sensitive component locations at plants designed by all four U. S. nuclear steam supply system (NSSS) vendors. The ANL fatigue curves were used by INEL to recalculate the cumulative usage factors (CUFs) for fatigue-sensitive component locations in early and late vintage Combustion Engineering (CE) pressurized water reactors (PWRs), early and late vintage Westinghouse PWRs, early and late vintage General Electric (GE) boiling water reactors (BWRs), and Babcock & Wilcox Company (B&W) PWRs. The results of the INEL calculations were published in NUREG/CR-6260 (Reference 14). The INEL calculations took advantage of conservatisms present in governing ASME Code fatigue calculations, including the numbers of actual plant transients relative to the numbers of design-basis transients, but did not recalculate stress ranges based on actual plant transient profiles. The BWR calculations, especially the early-vintage GE BWR calculations, are directly relevant to MNGP.

In order to comply with the requirements, MNGP has evaluated the locations specified in NUREG/CR-6260 for the older vintage BWR plants. These locations consist of:

- Reactor Vessel (Lower Head to Shell Transition)
- Feedwater Nozzle
- Recirculation System (Vessel Nozzles and RHR Return Line Tee)

- Core Spray System (Nozzle/Safe End)
- Residual Heat Removal Piping (Tapered Transition)
- Limiting Feedwater Piping Location

For each location, detailed environmental fatigue calculations have been performed using F_{en} relationships for carbon and low-alloy steel locations (NUREG/CR-6583) and stainless steel locations (NUREG/CR-5704). The calculations incorporate F_{en} methodology to determine a multiplier on the cumulative usage factor (CUF) so that environmental effects can be assessed. As can be seen in Table A3.7-1, all locations are acceptable through the extended term of operation due to the fact that all CUFs remain below the acceptance criteria of 1.0.

Table A3.7-1 Summary of Environmental Fatigue Usage Factors for MNGP

Location	Component	Material	Usage Factor (U_{env})
Reactor Vessel	Shell	Carbon Steel	0.569
Feedwater Nozzle	Safe End	Carbon Steel	0.938
Recirculation Inlet Nozzle	Safe End	Stainless Steel	0.749
Core Spray Nozzle	Safe End	Carbon Steel	0.194
Recirculation Piping	RHR Tee	Stainless Steel	0.864
Feedwater Piping	FWTR/RCIC Tee	Carbon Steel	0.513

Disposition: Revision 10 CFR 54.21(c)(1)(ii)

The cumulative usage factors for all locations, when conservatively re-evaluated to include environmental effects, remains below 1.0. Although, based on a projection of experienced cycles, these locations have been shown to be acceptable through the period of extended operation, the MNGP thermal fatigue monitoring program periodically reviews and updates fatigue analyses to ensure continued compliance with fatigue acceptance criteria.

A3.8 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 loss-of-coolant-accident (LOCA) scenario and safety relief valve (SRV) operation.

Containment fatigue analyses are provided for the following groups:

- Fatigue Analysis of the Suppression Chamber, Vents, and Downcomers
- Fatigue Analysis of the SRV Discharge 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 Analyses

Fatigue Analysis of the Suppression Chamber, Vents, and Downcomers

Summary Description

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.

Analysis

Analysis of the suppression chamber, vent system and downcomers (Reference 17) identified that the vent header-downcomer intersection and the torus shell were limiting in terms of fatigue usage. Fatigue usages for all other locations were found to be less than 0.015. The calculated values for the vent header-downcomer intersection and the torus shell were 0.684 and 0.66 respectively. Subsequent to that evaluation, all locations were re-evaluated for the effects of power rerate implemented in 1998. It was estimated that power rerate conditions could result in an increase in the number of SRV cycles experienced due to higher steaming rates at increased power levels. The number of cycles was estimated to increase by 14 percent coincident with the increase to 1775 MWt (from 1670 MWt) and by 26 percent due to an increase to 1880 MWt.

The revised fatigue evaluation conservatively estimated the fatigue usage of the vent header-downcomer intersection as 0.862 (1.26 x 0.684). The revised maximum fatigue for the torus shell was similarly calculated to be 0.98, using increased SRV actuations postulated for rerate conditions and applicable event combinations.

Disposition: Validation, 10 CFR 54.21(c)(1)(i) and Aging Management, 10 CFR 54.21(c)(1)(iii)

All locations with the exception of the vent header-downcomer intersection and the torus shell have reported 40 year fatigue usage factors of less than 0.2. Consequently, those locations are validated by review of the current analyses (e.g. Umax,40 < 0.20, x 60/40 = Umax,60 = 0.30<<1.0).

Since only the SRV load cases contribute to fatigue during normal operation, operation may continue until the contribution from SRV discharges has not exceeded the conservative design values used in the evaluation.

The MNGP cycle based fatigue monitoring program includes periodic counting of the SRV cycles, comparing the total number of experienced SRV cycles to the design basis number of cycles and, confirming that the fatigue usage will remain below the acceptance criteria of 1.0 or identifying when the limit is likely to be exceeded such that adequate corrective measures can be implemented. As of December 31, 2003 the total number of normal operation SRV lifts experienced at the MNGP was 506 and the design basis is 934. Extrapolation of current SRV lifts results in an conservative estimate due to the fact that counted lifts do not differentiate the operating condition at which the lift was experienced (e.g., power level), the design value of 934 postulates that all SRVs lifts occur in the same suppression chamber bay and, the rate of SRV challenges experienced in the first 7 years of operation is significantly higher than subsequently experienced. Without consideration for these conservatisms, 414 additional challenges can be expected throughout the 60 year extended operating period. This would result in a 60 year SRV total of 920.

All applicable plant cycles are currently monitored to ensure that the cumulative usage factors remains below 1.0 for the limiting components. In the unlikely event that fatigue usage is predicted to exceed 1.0 prior to 60 years of operation, appropriate corrective action will be taken in accordance with the MNGP Corrective Action Program.

Fatigue Analysis of the SRV Piping Inside the Suppression Chamber and Internal Structures

Summary Description

The Reactor Pressure Relief System includes safety/relief valves (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:

- Overpressure relief - The valves open to limit the pressure rise in the reactor.

- Depressurization - The valves are opened to depressurize the reactor.

The Plant Unique Analysis Report (Reference 18) 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.

Analysis

The criteria presented in Volume 5 of the MNGP PUAR (Reference 18) describes the evaluation of the SRVDL piping system. The evaluation included the effects of LOCA related loads and SRV discharge related loads. LOCA and SRV discharge loads were formulated using procedures and test results which included the effects of plant unique geometry and operating parameters contained in the Plant Unique Load Definition (PULD) report (Reference 19). The analysis also considered the interaction effects of the vent system and the suppression chamber.

Per (Reference 18), the critical location for fatigue usage is the SRV piping at the elbow adjacent to the elbow support beam junction. The fatigue usage for this location was calculated to be 0.309.

Subsequent to that evaluation, this location was reevaluated for the effects of power rerate implemented in 1998. It was estimated that power rerate conditions could result in an increase in the number of SRV cycles experienced due to higher steaming rates at increased power levels. The number of cycles was estimated to increase by 14 percent coincident with the increase to 1775 MWt (from 1670 MWt) and by 26 percent due to an increase to 1880 MWt. Conservatively using the 1880 MWt SRV factor, an increase to 0.389 was calculated.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

The limiting location for the SRV piping is less than 0.40. Current analyses are validated by:

$$U_{max,40} < 0.40, \times 60/40 = U_{max,60} < 0.60 < 1.0$$

This increase in service life does not significantly effect SRV discharge piping fatigue usage. Consequently, the current calculation is validated for the period of extended operation.

Fatigue Analysis of Suppression Chamber External Piping and Penetrations

Summary Description

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.

Analysis

Rigorous analytical techniques were used to evaluate the effects of LOCA related and SRV discharge loads as defined in the NRC's Safety Evaluation Report NUREG-0661 and in the Mark I Containment Load Definition Report (Reference 20). These techniques included detailed analytical models and refined methods for computing the dynamic response of the TAP systems which included consideration of the interaction effects of each piping system and the suppression chamber.

The results of the TAP structural analysis for each load type were used to evaluate load combinations for the piping and penetrations in accordance with NUREG-0661 and the Mark I Containment Program Structural Acceptance Criteria Plant Unique Analysis Application Guide (PUAGG). The analysis results were compared with the acceptance limits specified in the PUAAG and the applicable sections of the ASME Code for Class 2 piping and for Class MC components.

Fatigue effects were specifically addressed for the suppression chamber penetrations and the suction header, whereas the evaluation for the piping was generically addressed for all Mark I plants by the Mark I Owners' Group. Analyses documented in this report identify cumulative usage factors for the Mark I plants of less than 0.5. The generic fatigue evaluation included 36 piping systems from 15 plants. Stress results for the most limiting piping systems and locations were selected for each plant. Thus, the reported usage factors are representative of the most limiting location within the data for the plant group. For MNGP, the SRV discharge piping was identified as the limiting location. The SRV discharge piping was re-evaluated for the effects of power rerate, which was implemented in 1998. It was estimated that power rerate conditions could result in an increase in the number of SRV cycles experienced due to higher steaming rates at increased power levels. The number of cycles was estimated to increase by 14 percent coincident with the increase to 1775 MWt (from 1670 MWt) and by 26 percent due to an increase to 1880 MWt. Conservatively using the 1880 MWt SRV factor, an increase to 0.389 was calculated.

The TAP penetration fatigue usage was conservatively evaluated for the effects of power rerate by increasing the SRV cycles by a factor of 1.26 to correspond to a power level of

1880 MWt (the actual rerate power level was 1775 MWt, which corresponds to a 1.14 SRV factor). This conservative application, in addition to the bounding analysis, confirmed that fatigue usage for the TAP penetrations would remain below 1.0 (0.985) based on cycles anticipated to occur during the 40 year operating life of MNGP.

Disposition: Validation, 10 CFR 54.21(c)(1)(i) and Aging Management, 10 CFR 54.21(c)(1)(iii)

The limiting location for TAP is less than 0.40. Current analyses are validated by:

$$U_{max,40} < 0.40, \text{ x } 60/40 = U_{max,60} < 0.60 < 1.0$$

This increase in service life does not significantly effect TAP fatigue usage. Consequently, the current calculation is validated for the period of extended operation.

Conversely, although TAP penetration fatigue usage has been conservatively validated for 40 years of operation there is not sufficient margin to project additional cycles for a 60 year extended term of operation and remain below the acceptance criteria of 1.0.

Since SRV load cases are the primary contributor to fatigue during normal operation, operation may continue until the contribution from SRV discharges has not exceeded the conservative design values used in the evaluation.

The MNGP cycle based fatigue monitoring includes periodic counting of the SRV cycles. The SRV cycles are compared to the design basis number of cycles to confirm that the fatigue usage will remain below the acceptance criteria of 1.0 and to provide timely identification of when the limit may be exceeded such that adequate corrective measures can be enacted. As of December 31, 2003 the total number of SRV lifts experienced at the MNGP was 506. Projecting this rate of SRV lifts throughout 60 years of operation indicates that the fatigue usage will remain below 1.0 for the period of extended operation.

All applicable plant cycles are currently monitored to ensure that the cumulative usage factors remains below 1.0 for the limiting components. In the unlikely event that fatigue usage is predicted to exceed 1.0 prior to 60 years of operation, appropriate corrective action will be taken in accordance with the MNGP Corrective Action Program.

Drywell-to-Suppression Chamber Vent Line Bellows Fatigue Analysis

Summary Description

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.

Analysis

The suppression chamber is in the general form of a torus, which is below and encircles the drywell. The suppression chamber is connected to the drywell by eight vent lines which are connected to a common header. A vent line bellows assembly connects each vent line to the suppression chamber allowing for differential movement between the drywell and the suppression chamber.

Vent line bellows stresses are due primarily to differential thermal expansion of the reactor pressure vessel and the drywell during normal startup and shutdown evolutions and, due to accident conditions. The original vent line bellows was designed and analyzed in accordance with ASME Section III, 1965 Edition including the Summer 1966 Addenda. The current evaluation was performed in accordance with ASME Section III, Subsection NC, using the 1995 Edition including the 1996 Addenda. The current analysis for the vent line bellows conservatively used as the basis for the expected number of cycles to be experienced during the forty (40) year design life 300 startup/shutdown cycles and 1 cycle due to postulated accident conditions.

The result of this analysis was confirmation that cumulative usage factor (CUF) is significantly below the acceptance criteria of 1.0 for the 40 year design life.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

By inspection of the current analysis, which predicts a maximum 40 year design CUF of 0.10, the fatigue adequacy of the vent line bellows at MNGP is validated. The capacity of the vent line bellows is adequate for the number of transient cycles expected during the extended 60 year operating period.

$$U_{max,40} = 0.10, \times 60/40 = U_{max,60} = 0.15 < 1.0$$

Primary Containment Process Penetration Bellows Fatigue Analysis

Summary Description

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.

Analysis

At MNGP, the only containment process piping that is subject to significant thermal expansion and contraction are those that penetrate the drywell shell. Typically these penetrations, which were designed to the ASME Code, Section III, Class B requirements, are a triple flued head design which has a guard pipe between the process piping and the penetration nozzle. This permits the penetration to be vented to the drywell should a rupture of the hot line occur within the penetration.

These containment penetration process bellows have been designed for a minimum of 7,000 operating cycles.

Disposition: Validation, 10 CFR 54.21(c)(1)(i)

Transient cycles on the bellows are composed primarily of thermal cycles experienced by the attached piping. The cycle requirements can be conservatively approximated by the maximum number of thermal cycles specified for any reactor pressure vessel nozzle. For MNGP the limiting nozzle from a total cycle standpoint is the feedwater nozzle, which has as its design basis 1,500 applied cycles for a 40 year operating period. For the 60 year extended operating period, the number of cycles can be estimated by multiplying the 40 year value times 1.5 which results in an estimated design cycle expectation of less than 2,250 or less than one-third of the original design requirement. Consequently, the current containment penetration bellows fatigue design criteria remain valid with significant margin for the 60 year extended operating period.

A3.9 Environmental Qualification of Electrical Equipment (EQ)

Summary Description

10 CFR 50.49, Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants, specifically requires that an environmental qualification program be established to demonstrate that certain electrical components located in “harsh” plant environments are qualified to perform their safety function in those harsh environments after the effects of in-service aging.

The MNGP Environmental Qualification Program meets the requirements of 10 CFR 50.49 for the applicable components important to safety.

10 CFR 50.49(e)(5) contains provisions for aging that include consideration of all significant types of aging degradation that can affect component functional capability.

10 CFR 50.49(e) also requires replacement or refurbishment of components qualified for less than the current license term prior to the end of designated life unless additional life is established through ongoing qualification.

Supplementary EQ regulatory guidance for compliance with these different qualification criteria is provided in the Division of Operating Reactors (DOR) Guidelines (Reference 16), NUREG-0588, Regulatory Guide 1.89, and in Generic Letter 82-09.

The MNGP EQ Program manages component thermal, radiation and cyclical aging through the use of aging evaluations based on 10 CFR 50.49(f) qualification methods. Aging evaluations for EQ components that specify a qualification of at least 40 years are TLAAs for license renewal. The EQ Program will manage the aging effects of applicable components in the EQ program. Section 4.4.2.1.3 of NUREG-1800 states that the staff has evaluated the EQ Program (10 CFR 50.49) and determined that it is an acceptable aging management program to address EQ according to 10 CFR 54.21(c)(1)(iii), Aging Management. This evaluation is documented in NUREG-1801, “Generic Aging Lessons Learned (GALL) Report,” Section X.E1, “Environmental Qualification of Electric Components.”

The MNGP EQ Program is an existing program, established to meet commitments for 10 CFR 50.49, that are consistent with NUREG-1801, “Generic Aging Lessons Learned (GALL) Report,” Section X.E1, “Environmental Qualification of Electric Components.” In accordance with 10 CFR 54.21(c)(1)(iii), the EQ Program, which implements the requirements of 10 CFR 50.49, is viewed as an aging management program for license renewal. Reanalysis of an aging evaluation to extend the qualification of components under 10 CFR 50.49(e) is performed as part of the EQ Program at MNGP.

Analysis

Aging evaluations of electrical components in the EQ program at MNGP that specify a qualified life of at least forty years are TLAAs.

Aging evaluations are normally performed to extend the qualification by reducing excess conservatism incorporated in the prior evaluation or by including new aging data. While a component life limiting condition may be due to thermal, radiation, or cyclical aging, the majority of component aging limits are based on thermal conditions. Conservatism may exist in aging evaluation parameters such as the assumed ambient temperature of the component, the activation energy, or in the application of a component (e.g. de-energized vs. energized). Important attributes of a reanalysis include analytical methods, data collection and reduction methods, underlying assumptions, acceptance criteria and corrective actions (if acceptance criteria are not met). These attributes are discussed in more detail below.

- Analytical Methods - The MNGP EQ Program generally uses the same analytical models in the reanalysis of an aging evaluation as those previously applied for the current evaluation. The Arrhenius methodology is an acceptable model for performing a thermal aging evaluation. The analytical method used for a radiation aging evaluation is to demonstrate qualification for the total integrated dose (that is, normal radiation dose for the projected installed life plus accident radiation dose). For license renewal, acceptable methods for establishing the 60 year normal radiation dose includes multiplying the 40 year normal radiation dose by 1.5 (that is, 60 years/40 years) or using the actual calculated value for 60 years. The result is added to the accident radiation dose to obtain the total integrated dose for the component. In some cases, the normal radiation dose is insignificant when compared to the accident dose. In such cases the accident dose may be valid for both the 40 year and 60 year dose. For cyclical aging a similar approach may be used. Other models may be justified on a case-by-case basis.

- Data Collection and Reduction Methods - Reducing excess conservatism in the component service conditions (for example, temperature, radiation, cycles) used in the prior aging evaluation is the primary method used for a reanalysis per the EQ Program. Temperature data used in an aging evaluation should be conservative and based on plant design temperature or on actual plant temperature data. When used, plant temperature data can be obtained in several ways including monitors used for technical specification compliance, other installed monitors, measurements made by plant operators during rounds, and temperature sensors on large motors (while the motor is not running). A representative number of temperature measurements are conservatively evaluated to establish the temperature used in an aging evaluation. Plant temperature data may be used in an aging evaluation in different ways, such as (a) directly applying the plant temperature data in the evaluation or (b) using the plant temperature data to demonstrate conservatism when using plant design temperatures for an evaluation. Any changes to the material activation energy values as part of a reanalysis are to be justified on a plant specific basis. Similar methods of reducing excess conservatism in the component service conditions used in prior aging evaluations can be used for radiation and cyclical aging.
- Underlying Assumptions - EQ component aging evaluations contain sufficient conservatism to account for most environmental changes occurring due to plant modifications and events. When unexpected adverse conditions are identified during operational or maintenance activities that affect the normal operating environment of a qualified component, the affected EQ component is evaluated and appropriate corrective actions are taken, which may include changes to the qualification bases and conclusions.
- Acceptance Criteria and Corrective Action - The reanalysis of an aging evaluation could extend the qualification of the component. If the qualification cannot be

extended by reanalysis, the component is maintained, replaced, or re-qualified prior to exceeding the period for which the current qualification remains valid. A reanalysis is performed in a timely manner (that is, sufficient time is available to maintain, replace, or re-qualify the component if the reanalysis is unsuccessful).

Disposition: Aging Management, 10 CFR 54.21(c)(1)(iii)

Based on a review of the MNGP EQ Program and operating experience, the continued effective implementation of the program provides reasonable assurance that (a) the aging effects will be managed, and (b) EQ components will continue to perform their intended function(s) consistent with the current licensing basis for the period of extended operation. Therefore, the MNGP EQ Program is an acceptable aging management program for license renewal under 10 CFR 54.21(c)(1)(iii) during the period of extended operation.

A3.10 Reactor Building Crane Load Cycles

Summary Description

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 off site 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 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.

Analysis

Reactor Building Crane System design conservatively considers that the following heavy load cycles will be required during the 40 year plant life: 20 lifts per year of Reactor Building shield blocks and plugs, 2 lifts per year of the reactor vessel head, 2 lifts per year of the drywell vessel head, 2 lifts per year of the steam separator assembly and, 2 lifts per year of the steam dryer assembly.

Without consideration for the fact that the modified Reactor Building Crane System was installed after several years of operation the total amount of heavy lifts expected during a 40 year life is 1,120 cycles.

Disposition: Validation, 10 CFR54.21(c)(1)(i)

The Reactor Building Crane was conservatively designed to handle up to 70,000 heavy loads over the 40 year operating life of the plant. By inspection, the crane is expected to be subjected to less than 2,000 heavy lifts during the 60 year extended operating period, which is significantly less than the design value. Therefore, fatigue life is not significant for the operation of the Reactor Building Crane System and the current analysis remains valid for the period of extended operation.

A3.11 Fatigue Analyses of HPCI & RCIC Turbine Exhaust Penetrations

Summary Description

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.

Analysis

The existing evaluation of the High Pressure Coolant Injection turbine exhaust nozzle used test conditions of 292^{o}F and 50 psig in conjunction with Mark I loads to calculate a cumulative fatigue usage factor. The main conclusion of this evaluation was that the maximum number of High Pressure Coolant Injection turbine tests allowed was only 260, or approximately one test every other month assuming a 40 year plant life.

The major factor was the design temperature of 292^{o}F, the saturated steam temperature associated with the torus at a design pressure of 50 psig. Since the normal operating pressure of the torus is close to atmospheric, it was believed that the actual test temperature was closer to 212^{o}F. To confirm this, the High Pressure Coolant Injection and Reactor Core Isolation Cooling torus nozzles were instrumented to obtain the actual temperature responses during operational testing. The conclusion of these tests was that the maximum temperature that either of these nozzles will experience is expected not to exceed 225^{o}F. A thermal stress analysis was subsequently completed for both nozzles. Finite element models were developed for both nozzles which included explicit modeling of the nozzle to insert plate welds and nozzle to sleeve welds. The evaluation was performed for the following thermal load cases:

- A through wall temperature of the nozzle wall at 225^{o}F with the torus insert plate at 70^{o}F. This corresponds to the initial heatup of the nozzle that occurs immediately after turbine start.
- A through wall temperature of 118^{o}F to simulate a rapid cooldown which occurs during reflood. This corresponds to the average temperature of the Reactor Core Isolation Cooling nozzle immediately after turbine shutdown.

These two cases were separately evaluated for each penetration. Based on the results, usage factors were calculated in accordance with Section III, Subsection NE of the ASME code. The maximum peak stress ranges for the heatup and cooldown cycles are 77.4 ksi and 83.5 ksi for the High Pressure Coolant Injection and Reactor Core Isolation Cooling penetrations, respectively. Based on an assumption that 676 single safety relief valve (SRV) actuations and 258 multiple valve actuations will occur during the 40 year plant life, the SRV usage factors for the High Pressure Coolant Injection and Reactor Core Isolation Cooling nozzles are 0.009 and 0.043, respectively. The worst case fatigue loading for both nozzles that could be caused by Mark I LOCA loads is a DBA CO acting simultaneously with OBE. One turbine actuation cycle was also postulated for this case. From the Mark I program stress results, the maximum LOCA usage factors for the High Pressure Coolant Injection and Reactor Core Isolation Cooling nozzles are 0.044 and 0.228, respectively. By summing the usage factors for the SRV actuations and Mark I LOCA loads plus OBE, cumulative usage factors of 0.053 and 0.271 were obtained for the High Pressure Coolant Injection and Reactor Core Isolation Cooling nozzles, respectively.

<u>Disposition: Validation, 10 CFR 54.21(c)(1)(i)</u>

Considering that the effects of power rerate implemented in 1998 may increase the design cycles for SRV actuations by as much as 26 percent due to higher steaming rates (conservative percent increase corresponding to 1880 MWt), the maximum contribution due to SRV cycles is 1.26 times 0.043, or 0.054. Consequently, the maximum cumulative fatigue usage for 40 years is 0.282. This updated, current analysis, therefore, is validated for 60 years of operation by:

$$U_{max,40} = 0.282, \times 60/40 = U_{max,60} = 0.423 < 1.0$$

This results in a minimum of 0.577 available fatigue usage due to operational testing of the Reactor Core Isolation Cooling turbine which corresponds to 3,826 operational tests (an average of more than 5 tests per month over the 60 year extended life).

A4 TLAA SUPPORTING ACTIVITIES

A4.1 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. The MNGP program will continue through the end of the 20-year period of extended operation.

A4.2 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, MNGP has evaluated environmental effects in accordance with NUREG/CR-6260, “Application of NUREG/CR-5999 Interim Fatigue Curves for Selected Nuclear Power Plant Components.” Selected components were evaluated using material specific guidance presented in NUREG/CR-6583 for carbon and low alloy steels and in NUREG/CR-5704 for austenitic stainless steels. The MNGP program ensures that limiting components remain within the acceptance criteria for cumulative fatigue usage throughout the licensed term and, that if trends indicate otherwise, appropriate corrective action can be implemented.

A4.3 Exemptions

The requirements of 10 CFR 54.21(c) stipulate that the application for a renewed license should include a list of plant-specific exemptions granted pursuant to 10 CFR 50.12 and that are based on time-limited aging analyses, as defined in 10 CFR 54.3. Each active 10 CFR 50.12 exemption has been reviewed to determine whether the exemption is based on a time-limited aging analysis. No existing TLAA related exemptions were identified.

Appendix A References

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2. 10 CFR 54.3, “Requirements for Renewal of Operating Licenses for Nuclear Power Plants-Definitions,” May 8, 1995.

3. Letter, S.A. Richard (NRC) to J.F. Klapproth (GE), “Safety Evaluation for NEDC-32983P, General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluation,” (TAC No. MA9891) MFN 01-050, September 14, 2001.

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5. EPRI report TR-1003346, “Updated BWR Integrated Surveillance Program (ISP) Implementation Plan,” October 2002 (BWRVIP-86-A) (EPRI Proprietary).

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7. Ranganath, S., “Fracture Mechanics Evaluation of a Boiling Water Reactor Vessel Following a Postulated Loss of Coolant Accident,” Fifth International Conference on Structural Mechanics in Reactor Technology, Berlin, Germany, August 1979, Paper G1/5.

8. Appendix A to Section XI of the ASME Boiler and Pressure Vessel Code, 1989 Edition.

9. EPRI TR-108279, “Fracture Toughness and Tensile Properties of Irradiated Austenitic Stainless Steel Components Removed from Service,” (BWRVIP-35), EPRI, Palo Alto CA, June 1997 (EPRI Proprietary Information).

10. Gus C. Lainas (NRC) to Carl Terry (Niagara Mohawk Power Company), BWRVIP Chairman, “Final Safety Evaluation of the BWRVIP Vessel and Internals Project BWRVIP-05 Report,” (TAC No. M93925), July 28, 1998.

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supplementing letters of June 24 and October 29, 1996, May 16, June 4, June 13, and December 18, 1997, and January 13, 1998. (EPRI Proprietary Information)

12. Jack R. Strosnider (NRC), to Carl Terry (BWRVIP Chairman), “Supplement to Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report,” (TAC No. MA3395), March 7, 2000.

13. NUREG-0619, “BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking,” November 1980

14. NUREG/CR-6260, “Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components,” March 1995.

15. EPRI Report 1007824, “Integrated Surveillance Program (ISP) Implementation for License Renewal,” July 2003 (BWRVIP-116)(EPRI Proprietary).

16. DOR Guidelines, “Guidelines for Evaluating Environmental Qualification of Class 1E Electrical Equipment in Operating Reactors, U.S. Nuclear Regulatory Commission, June 1979.

17. Monticello PUAR, Volume 3, Vent System Analysis, NSP-74-103, Revision 1, November 1982.

18. Monticello PUAR, Volume 5, Safety Relief Valve Discharge Piping Analysis, NSP-74-105, Revision 1, November 1982.

19. Mark I Plant Unique Load Definition, Monticello Nuclear Generating Plant, NEDO-24576, Rev. 1, October 1981

20. Mark I Containment Program Load Definition Report, NEDO-21888, Revision 2 December 1981

APPENDIX B

AGING MANAGEMENT PROGRAMS

APPENDIX B
Contents

B1 APPENDIX B INTRODUCTION

B1.1 General Aging Management Program Methodology

Each applicant is required to demonstrate that the effects of aging will be adequately managed so that the intended functions of structures and components within the scope of LR will be maintained during the period of extended operation. 10 CFR 54.21(a)(3) states:

> For each structure and component identified in paragraph (a)(1) of this section, demonstrate that the effects of aging will be adequately managed so that the intended function(s) will be maintained consistent with the Current Licensing Basis (CLB) for the period of extended operation.

The MNGP Aging Management Review (AMR) process, discussed in Section 3.0, Aging Management Review Results, of this report identifies the Aging Effects Requiring Management (AERMs). The method used, almost exclusively, to adequately manage the effects of aging, is to establish aging management programs (AMPs). Aging management activities (AMAs) are then credited within these AMPs, which manage aging in structures and components before there is a loss of intended function. The guidance in NEI 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule," (Reference 1) was used in this process.

In general, there are four types of AMPs:

- Prevention Programs preclude aging effects from occurring.
- Mitigation Programs slow the effects of aging.
- Condition Monitoring Programs inspect/examine for the presence and extent of aging.
- Performance Monitoring Programs test the ability of a structure or component to perform its intended function.

Part of the demonstration that the effects of aging are adequately managed is to evaluate credited programs and activities against certain recommended attributes. Appendix A.1 and A.2 to NUREG-1800, Standard Review Plan for Review of Licensee Renewal Applications for Nuclear Power Plants (SRP-LR) (Reference 2), and Appendix A to NUREG-1801, Generic Aging Lessons Learned Report (GALL Report) (Reference 3), recommends that ten attributes be addressed in demonstrating the effectiveness of AMPs. An AMP should satisfy the following ten attributes, as applicable:

1. Scope

The scope of the program/activity should include the specific structures and components subject to an aging management review for license renewal.

2. Preventive Actions

Preventive actions are in effect that mitigate or prevent the onset of degradation or aging effects, and their effectiveness is periodically verified.

3. Parameters Monitored or Inspected

Parameters are monitored or inspected, that provide direct information about the relevant aging effect(s), and their impact on intended functions.

4. Detection of Aging Effects

The aging effect(s) are detected by one or more of the credited programs before there is a loss of the structure's or component's intended function.

5. Monitoring and Trending

Monitoring and trending provides an adequate predictability and timely, corrective or mitigative actions.

6. Acceptance Criteria

The program(s) contains acceptance criteria against which the need for corrective action will be evaluated, and ensures that timely corrective action will be taken when these acceptance criteria are not met.

7. Corrective Actions

Corrective actions are taken (this includes root cause determinations and prevention of recurrence where appropriate) in a timely manner or an alternative action is identified.

8. Confirmation Process

There is a confirmation process that ensures that the corrective action was taken and was effective.

9. Administrative Controls

The program(s) is subject to administrative controls.

10. Operating Experience

Operating experience of the program/activity, including past corrective actions resulting in program enhancements, should be considered. It provides objective evidence that the effects of aging have and will continue to be adequately managed.

Credit is taken for existing plant programs whenever possible. As such, all programs and activities associated with a structure or component were considered. Existing programs and activities that apply to structures, components, or commodity groupings are reviewed to determine whether they include the necessary actions (i.e. activities) to manage the effects of aging.

Existing plant programs were often based on a regulatory commitment or requirement, other than aging management. Many of these existing programs actually managed aging effects and included most of the required attributes. However, this was usually not recognized in the program implementing documents. If an existing program could not be found to adequately manage an identified aging effect, an existing program was modified or enhanced as necessary. Occasionally, creation of a new program is necessary.

Program basis documents (PBDs) were developed for each of the AMPs credited for LR. The purpose of the PBDs are to:

- Provide the justification, bases, and technical description of how the referenced aging management program or programs will manage the associated aging effects.
- Provide the program owner with the sources and basis to manage, with reasonable assurance, the associated aging effect for the period of extended operation.
- Provide the text for Appendix B of the License Renewal Application.
- Provide a source for the program commitments contained in the USAR supplement, which will be included in the MNGP LRA.
- Provide the necessary information to demonstrate that an aging management program adequately manages aging effects for structures, components, and commodity groupings within the scope of license renewal at MNGP.

PBDs only provide the basis of a program as it relates to LR. They do not document other bases for programs, such as NRC commitments, ASME Code requirements, or regulatory requirements.

PBDs are the basis for the LR program descriptions in the USAR Supplement in Appendix A of the LRA. The PBDs are also used as input to Appendix B of the LRA, which contains a description of the AMPs and how they satisfy the NRC's ten recommended attributes of a successful program.

B1.2 Aging Management Program Development Process

To support the License Renewal Project schedule at the MNGP, AMPs and associated PBDs were developed in parallel with the scoping, screening, and AMR processes. This effort consisted of four distinct phases as outlined below.

Phase 1

AMPs expected to be credited for managing aging effects for LR were identified by reviewing prior LRAs and NUREG-1801. Short program descriptions were then developed for each of these AMPs. Existing plant programs that corresponded to the AMPs were then identified, including the program owners and implementing documents if known.

Phase 2

PBDs were drafted based on the AMPs in prior LRAs and NUREG-1801, and the implementing documents from the existing plant programs. The draft PBDs were then sent out for review and comment to LR Project personnel, system engineers, and program owners.

Phase 3

The results of the Operating Experience (OE) review, the AMPs credited during the AMR process, and the comments from Phase 2 were incorporated into the draft PBDs. Each of the PBDs was evaluated against the ten elements described in Appendix A.1, “Aging Management Review - Generic,” Table A.1-1, “Elements of an Aging Management Program for License Renewal,” of the SRP-LR. The draft PBDs were then again sent out for review and comment.

Phase 4

Comments from the Phase 3 reviews were incorporated into the draft PBDs. The PBDs were then finalized, reviewed, approved, and issued as Revision 0.

Aging management program descriptions are provided in this appendix for each program credited for managing aging effects based upon the aging management review results provided in Section 3.

The evaluation of each of the ten elements is provided for each program. Enhancements to the aging management programs are also described in this appendix.

For those aging management programs that are consistent with or consistent with exceptions to the program descriptions in Sections X and XI of NUREG-1801 a discussion is presented in the following form:

- A program description abstract of the overall program form and function is provided.
- A NUREG-1801 consistency statement is made about the program.

- Exceptions to the NUREG-1801 program are outlined and a justification provided. Exceptions are site/station program element differences with literal compliance with NUREG-1801 specified guidance criteria. Essentially, there should be a one-to-one correspondence with the NUREG-1801 aging management program element; if not, it is an exception.
- Enhancements to the program are identified. Enhancements are specific changes made, or to be made, to existing site/station programs/procedures to make the program consistent with the related NUREG-1801 aging management program element. The enhancement upgrades the existing site/station program/procedure to provide reasonable assurance that the respective aging effect(s) will be managed for the duration of extended operation.
- An element by element discussion is provided for each program. Comparisons are made and evaluated for each NUREG-1801 program element.
- A conclusion section that provides reasonable assurance that the program is or will be effective once enhanced.

For those aging management programs that are plant-specific, each program discussion is presented in the following form:

- A Program Description abstract of the overall program form and function is provided.
- Enhancements to the program to ensure consistency with the NUREG-1800 Branch Technical Position program elements are identified. A proposed schedule for completion is also discussed.
- An element by element discussion is provided for each program.
- A Conclusion section that provides reasonable assurance that the program is or will be effective once enhanced.

B1.3 Quality Assurance Program and Administrative Controls

The elements of corrective action, confirmation process, and administrative controls in the Quality Assurance Program will be applicable to safety related and non-safety related systems, structures, and components subject to an AMR consistent with the summary in Appendix A.2 of NUREG-1800.

These three elements will be applicable as follows:

Corrective Actions

MNGP has a single corrective action process regardless of the safety classification of the structure or component. The corrective action process includes the work control process. Corrective action requirements are established in accordance with the requirements of 10

CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants" (Reference 4). Implementation is further described in the Operational Quality Assurance Plan (Xcel Energy, Inc.). This plan is applicable to MNGP.

The corrective action process at MNGP is implemented via site-specific administrative work instructions. These plant procedures require the initiation of an Action Request (AR) for actual or potential problems, including failures, malfunctions, discrepancies, deviations, defective material and equipment, nonconformances, and administrative control discrepancies.

Equipment deficiencies are corrected through the initiation of a Work Order (WO) in accordance with plant procedures. Although a WO may initially document equipment deficiencies, the corrective action process specifies that an AR also be initiated as discussed above.

MNGP site-specific administrative work instructions will be applicable to both safety and non-safety related systems, structures and components that are subject to an aging management review consistent with the current licensing basis during the period of extended operation.

Confirmation Process

The confirmation process is part of the corrective action program (described above). The focus of the confirmation process is on the follow-up actions that must be taken to verify effective implementation of corrective actions. The measure of effectiveness is in terms of correcting the adverse condition and precluding repetition of significant conditions adverse to quality. Plant procedures include provisions for timely evaluation of adverse conditions and implementation of any corrective actions required, including root cause determinations and prevention of recurrence where appropriate (e.g., significant conditions adverse to quality). These procedures provide for tracking, coordinating, monitoring, reviewing, verifying, validating, and approving corrective actions, to ensure effective corrective actions are taken. The AR process is also monitored for potentially adverse trends. The existence of an adverse trend due to recurring or repetitive adverse conditions would result in the initiation of an AR. The aging management activities required for license renewal would also uncover any unsatisfactory condition due to ineffective corrective action.

Since the same 10 CFR 50, Appendix B corrective actions and confirmation process is applied for nonconforming safety related and non-safety related structures and components subject to an AMR for license renewal, the MNGP corrective action program is currently consistent with these NUREG-1801 and NUREG-1800 elements.

Site documents that implement aging management activities for license renewal will be enhanced to ensure that an Action Request is prepared in accordance with plant procedures whenever non-conforming conditions are found (i.e., the acceptance criteria is not met).

Administrative Controls

The MNGP document control process applies to all MNGP generated documents, procedures, and instructions regardless of safety classification of the associated structure or component. Document Control processes are implemented in accordance with the requirements of 10 CFR 50, Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants.” Implementation is further defined in the Operational Quality Assurance Plan, (Xcel Energy, Inc.) Section 8.0, “Document Control.” The Operational Quality Assurance Plan is applicable to MNGP and the MNGP administrative work instructions. The document control requirements will apply to aging management programs.

Enhancements to license renewal related procedures and other document types will be made to include a purpose section discussing management of the effects of aging for structures, systems, and components within the scope of license renewal with applicable references.

B1.4 Operating Experience

Operating experience (OE) is an important resource in identifying aging effects and evaluating the effectiveness of aging management programs.

The Corrective Action Program (Condition Reports, Action Requests) and interviews with site personnel were the primary sources of plant specific operating experience.

Since the materials used for structures and components at MNGP are common to most nuclear power plants and to many non-nuclear power plants that have long operating histories, industry-wide operating experience is also valuable. Screening of a large body of operating data yielded much useful data relating to aging of plant structures and components.

The MNGP plant-specific data and the industry-wide operating data were valuable in:

- Providing bases for determining which aging effects require management.
- Demonstrating that existing programs are adequately managing the effects of aging.
- Pointing out the need to enhance existing programs or the need for entirely new programs.

The effects and mechanisms of age related degradation for SSCs at the MNGP were developed from several sources. They include plant specific and industry OE, interviews with site personnel, EPRI document 1003659, Generic Communications Database Users

Manual, Version 3.0, Revision 5.0, September 2002, along with the associated EPRI Generic Communications Database and NUREG-1801. Known aging effects and mechanisms for a given environment and material have been incorporated into NUREG-1801, up to the time of its publication in July 2001.

With respect to Aging Management Programs, existing programs/activities must demonstrate, with objective evidence, that they are effective in managing the effects of aging if credited. OE related to the program/activity, including past corrective actions resulting in program enhancements, provides objective evidence the program adequately manages the effects of aging.

Collection of Plant Specific and Industry OE from Condition Reports

The MNGP Corrective Action Program is the first source of information for identifying plant specific age related degradation issues applicable to MNGP and one of many sources for the identification of industry operating experience. The MNGP Corrective Action Program requires the initiation of an Action Request (AR) to document plant specific and industry OE. In addition to plant specific and industry OE, the AR also documents findings from Self-Assessments, Licensee Event Reports, NRC Violations, INPO Reports, as well as equipment and program failures.

The MNGP Corrective Action Process database tracks and maintains AR status information. The Title, Description, and Action fields of the database were searched to identify ARs that have age related issues and the corresponding aging effects and mechanisms.

Collection of Industry OE from other Sources

EPRI conducted a study (1997) of the NRC generic communications and developed a Generic Communications database. This study evaluated the operating experience found in the NRC Generic Communications for aging related degradation issues. EPRI updated the study in 2001 and again in July 2002. The Generic Communications database contains the results of the reviews and references for all NRC Bulletins, Generic Letters, Circulars, Information Notices, Administrative Letters, NRC Regulatory Information Notices, and Outstanding Generic Safety Issues issued before July 2002. This information becomes part of OE database if applicable to MNGP SSCs.

Another source of industry OE are the outstanding NRC generic safety issues (GSI) associated with an identified aging effect or aging management practice. Up-to-date information related to the GSIs were obtained from the most recent quarterly report supplement to NUREG-0933, A Prioritization of Generic Safety Issues, available on the NRC website.

Engineer Interviews

Site personnel responsible for SSCs (i.e., System Engineers) and existing program owners are an important source of OE information. These individuals were interviewed whenever possible and the information they provided was very beneficial.

The interviews included discussions of both plant and industry OE that relates to the MNGP and the systems or programs for which the engineer is responsible. Any new information that may indicate age related degradation for a SSC becomes part of the OE database and subject to further evaluation. Documentation of all interviews is retained in the project files.

B1.5 Aging Management Programs

The following Aging Management Programs are described in this appendix. The programs are either generic in nature as discussed in NUREG-1801, or are plant-specific. All generic programs are either fully consistent with, or consistent with some exceptions, to the programs discussed in NUREG-1801.

1. 10 CFR 50, Appendix J [Section B2.1.1]
2. ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD [Section B2.1.2]
3. ASME Section XI, Subsection IWF [Section B2.1.3]
4. Bolting Integrity [Section B2.1.4]
5. Buried Piping & Tanks Inspection [Section B2.1.5]
6. Bus Duct Inspection Program [Section B2.1.6]
7. BWR Control Rod Drive Return Line Nozzle [Section B2.1.7]
8. BWR Feedwater Nozzle [Section B2.1.8]
9. BWR Penetrations [Section B2.1.9]
10. BWR Stress Corrosion Cracking [Section B2.1.10]
11. BWR Vessel ID Attachment Welds [Section B2.1.11]
12. BWR Vessel Internals [Section B2.1.12]
13. Closed-Cycle Cooling Water System [Section B2.1.13]
14. Compressed Air Monitoring [Section B2.1.14]
15. Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements [Section B2.1.15]
16. Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrument Circuits [Section B2.1.16]

17. Fire Protection [Section B2.1.17]
18. Fire Water System [Section B2.1.18]
19. Flow-Accelerated Corrosion [Section B2.1.19]
20. Fuel Oil Chemistry [Section B2.1.20]
21. Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements [Section B2.1.21]
22. Inspection of Overhead Heavy Load & Light Load (Related to Refueling) Handling Systems [Section B2.1.22]
23. One-Time Inspection Program [Section B2.1.23]
24. Open-Cycle Cooling Water System [Section B2.1.24]
25. Plant Chemistry Program [Section B2.1.25]
26. Primary Containment In-Service Inspection Program [Section B2.1.26]
27. Protective Coating Monitoring & Maintenance Program [Section B2.1.27]
28. Reactor Head Closure Studs [Section B2.1.28]
29. Reactor Vessel Surveillance [Section B2.1.29]
30. Selective Leaching of Materials [Section B2.1.30]
31. Structures Monitoring Program [Section B2.1.31]
32. System Condition Monitoring Program [Section B2.1.32]
33. Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) [Section B2.1.33]

B1.6 BWRVIP Applicant Action Items

The aging management programs identified above contain references to applicable Boiling Water Reactor Vessel Internals Project (BWRVIP) documents, several of which have received a License Renewal Safety Evaluation Report (LR SER) from the NRC. Each LR SER contains License Renewal Applicant Action Items (AAIs) that are to be addressed in the plant specific LR application. For MNGP, the following BWRVIP documents contain AAIs:

- BWRVIP-74-A, BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal
- BWRVIP-18, BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines
- BWRVIP-25, BWR Core Plate Inspection and Flaw Evaluation Guidelines
- BWRVIP-26-A, BWR Top Guide Inspection and Flaw Evaluation Guidelines

- BWRVIP-27-A, BWR Standby Liquid Control System/Core Plate DP Inspection and Flaw Evaluation Guidelines
- BWRVIP-38, BWR Shroud Support Inspection and Flaw Evaluation Guidelines
- BWRVIP-41, BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines
- BWRVIP-47-A, BWR Lower Plenum Inspection and Flaw Evaluation Guidelines
- BWRVIP-48-A, BWR Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines
- BWRVIP-49-A, BWR Instrument Penetration Inspection and Flaw Evaluation Guidelines

As noted in the LR SER for BWRVIP-74-A, BWRVIPs-01, 05, and 63 will be reviewed for applicability for LR with the staff's review of BWRVIP-76. This review has not been completed for LR at this time. In addition, BWRVIP-42 (LPCI Coupling Inspection and Flaw Evaluation Guidelines) has been approved for LR with AAIs. BWRVIP-42 does not apply to MNGP. MNGP is a BWR-3 design and does not have an LPCI coupling for the low pressure coolant injection function.

The following Tables provide responses to the AAIs contained in the BWRVIPs applicable to MNGP that are identified above. It is recognized that the first three AAIs for most of the LR SERs are common to all. However, for completeness, each table contains the full response for each AAI applicable to the respective BWRVIP.

The examinations described as necessary for the management of the effects of aging on the functionality of the RPV components during the period of extended operation are summarized in BWRVIP-74-A, Table 4-1. Table B1.6-11 summarizes the response to each item in BWRVIP-74-A, Table 4-1, for the MNGP.

Table B1.6-1 Applicant Action Item Responses for BWRVIP-74-A - BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal

Applicant Action Item Text	Plant-Specific Response
(1) The LR applicant is to verify that the BWRVIP-74 report is applicable to its plant. Further, the LR applicant is to commit to programs described as necessary in the BWRVIP-74 report to manage the effects of aging on the functionality of the RPV components during the period of extended operation. LR applicants will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the AMP within the BWRVIP-74 report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor pressure vessel components or other information presented in the report, such as materials of construction, will have to be identified by the LR applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	MNGP participates in the BWRVIP. This BWRVIP is applicable to MNGP. The inspections necessary to manage the effects of aging on the functionality of the RPV components are summarized in Table 4-1 of BWRVIP-74-A. MNGP commitments to the various programs required by this BWRVIP are included in Table B1.6-11.
(2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those LR applicants referencing the BWRVIP-74 report for the RPV components shall ensure that the programs and activities specified as necessary in the BWRVIP-74 report are summarily described in the FSAR supplement.	The MNGP USAR supplement, Appendix A of this LRA, includes a summary description of the programs and activities as required in the AAI.

Table B1.6-1 Applicant Action Item Responses for BWRVIP-74-A - BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal

Applicant Action Item Text	Plant-Specific Response
(3) 10 CFR 54.22 requires that each LR application include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the LR application. In its Appendix A to the BWRVIP-74 report, the BWRVIP stated that the technical specification changes resulting from neutron embrittlement will be made at the appropriate time prior to the end of the current license. Those LR applicants referencing the BWRVIP-74 report for the RPV components shall ensure that the inspection strategy described in the BWRVIP-74 report does not conflict or result in any changes to their technical specifications. If technical specification changes do result, then the applicant should ensure that those changes are included in its LR application.	No technical specification changes are required for the inspection strategy described in the BWRVIP-74-A report.
(4) The staff is concerned that leakage around the reactor vessel seal rings could accumulate in the VFLD lines, cause an increase in the concentration of contaminants and cause cracking in the VFLD line. The BWRVIP-74 report does not identify this component as within the scope of the report. However, since the VFLD line is attached to the RPV and provides a pressure boundary function, LR applicants should identify any AMP for the VFLD line.	The MNGP reactor vessel flange leak detection lines are included within the scope of license renewal. See the scoping and screening results for Reactor Vessel Instrumentation (Section 2.3.1.5). The AMR results for the Reactor Vessel Instrumentation are described in Table 3.1.2-5.
(5) LR applicants shall describe how each plant-specific aging management program addresses the following elements: (1) scope of program, (2) preventive actions, (3) parameters monitored or inspected, (4) detection of aging effects, (5) monitoring and trending, (6) acceptance criteria, (7) corrective actions, (8) confirmation process, (9) administrative controls, and (10) operating experience.	A description of MNGP AMPs credited for license renewal is provided in Appendix B. These descriptions include a summary of all required elements (10) for each AMP.

Table B1.6-1 Applicant Action Item Responses for BWRVIP-74-A - BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal

Applicant Action Item Text	Plant-Specific Response
(6) The staff believes that inspection by itself is not sufficient to manage cracking. Cracking can be managed by a program that includes inspection and water chemistry. BWRVIP-29 describes a water chemistry program that contains monitoring and control guidelines for BWR water that is acceptable to the staff. BWRVIP-29 is not discussed in the BWRVIP-74 report. Therefore, in addition to the previously discussed BWRVIP reports, LR applications shall contain water chemistry programs based on monitoring and control guidelines for reactor water chemistry that are contained in BWRVIP-29.	As described in Section B2.1.10, the MNGP BWR Stress Corrosion Cracking Program includes water chemistry as a preventative measure. As discussed in Section B2.1.25, the MNGP Plant Chemistry Program is based on the monitoring and control guidelines that are contained in EPRI TR-1008192, BWRVIP-130: BWR Water Chemistry Guidelines - 2004 Revision. BWRVIP-130 supersedes BWRVIP-29 (EPRI-103515): BWR Water Chemistry Guidelines. MNGP uses radiolysis models to estimate hydrogen peroxide concentration as opposed to direct measurement.
(7) LR applicants shall identify their vessel surveillance program, which is either an ISP or plant-specific in-vessel surveillance program, applicable to the licensed term.	As described in Section B2.1.29, MNGP Reactor Vessel Surveillance Program is an integrated surveillance program (ISP).
(8) LR applicants shall verify that the number of cycles assumed in the original fatigue design is conservative to assure that the estimated fatigue usage for 60 years of plant operation is not underestimated. The use of alternative actions for cases where the estimated fatigue is projected to exceed 1.0 will require case-by-case staff review and approval. Further, a LR applicant must address environmental fatigue for the components listed in the BWRVIP-74 report for the LR period.	MNGP has reviewed the design basis and confirmed that the original fatigue design is conservative. Fatigue usages have been confirmed to remain below 1.0 for the extended period of operation and environmental fatigue has been addressed for the required components. See TLAA discussions in Section 4.3 (Metal Fatigue of the RPV and Internals, and Reactor Coolant Pressure Boundary Piping and Components) and Section 4.5 for MNGP's evaluation of the effects of the reactor coolant environment on fatigue.
(9) Appendix A to the BWRVIP-74 report indicates that a set of P-T curves should be developed for the heatup and cooldown operating conditions in the plant at a given EFPY in the LR period.	See the discussion in Section 4.2.5 for MNGP's disposition of the TLAA for neutron embrittlement and P-T curves for the LR period.

Table B1.6-1 Applicant Action Item Responses for BWRVIP-74-A - BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal

Applicant Action Item Text	Plant-Specific Response
(10) To demonstrate that the beltline materials meet the Charpy USE criteria in Appendix B or the report, the applicant shall demonstrate that the percent reduction in Charpy USE for their beltline materials are less than those specified for the limiting BWR3-6 plates and the non-Linde 80 submerged arc welds and that the percent reduction in Charpy USE for their surveillance weld and plate are less than or equal to the values projected using the methodology in RG 1.99, revision 2.	See TLAA discussion in Section 4.2.1, RPV Materials USE Reduction due to Neutron Embrittlement.
(11) To obtain relief from the in-service inspection of the circumferential welds during the LR period, the BWRVIP report indicates that each licensee will have to demonstrate that (1) at the end of the renewal period, the circumferential welds will satisfy the limiting conditional failure frequency for circumferential welds in the Appendix E of the staff's July 28, 1998, FSER, and (2) that they have implemented operator training and established procedures that limit the frequency of cold overpressure events to the amount specified in the staff's FSER.	The basis for relief during the LR period is included in Section 4.2.6 (RPV Circumferential Weld Examination Relief). This discussion and the associated relief request approvals substantiate compliance with conditional failure frequency requirements at the end of the license renewal period and that MNGP has implemented the necessary operator training and procedural controls.
(12) As indicated in the staff's March 7, 2000 letter to Carl Terry, a LR applicant shall monitor axial beltline weld embrittlement. One acceptable method is to determine the mean RTNDT of the limiting axial beltline weld at the end of the extended period of operation is less than the values specified in Table 1 of this FSER.	See the discussion of Axial Weld Failure Probability in Section 4.2.7. MNGP's evaluation concluded that the axial weld failure probability for the limiting axial beltline weld is bounded by the NRC analysis (e.g. Mod 2, 5.02E-6).

Table B1.6-1 Applicant Action Item Responses for BWRVIP-74-A - BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines for License Renewal

Applicant Action Item Text	Plant-Specific Response
(13) The Charpy USE, P-T limit, circumferential weld and axial weld RPV integrity evaluations are all dependent on neutron fluence. The applicant may perform neutron fluence calculations using a staff approved methodology or may submit the methodology for staff review. If the applicant performs the neutron fluence calculation using a methodology previously approved by the staff, the applicant should identify the NRC letter that approved the methodology.	MNGP used the methodology of GE Nuclear Energy topical Report NEDC-32983P, “General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluations,” to perform the neutron fluence calculation for embrittlement (see Section 4.2). Approval of this methodology is documented in the NRC's SER (Reference: Letter, S.A. Richards (NRC) to J.F. Klapproth, “Safety Evaluation for NEDC-32983P, General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluation (TAC No. MA9891),” MFN 01-050, September 14, 2001).
(14) Components that have indications that have been previously analytically evaluated in accordance with Subsection IWB-3600 of Section XI to the ASME Code until the end of the 40-year service period, shall be re-evaluated for the 60 year service period corresponding to the LR term.	There are no indications that have been previously evaluated in accordance with Subsection IWB-3600 of Section XI to the ASME Code until the end of the 40-year service period. Therefore, no indications require re-evaluation for the 60 year service period corresponding to the LR term.

Table B1.6-2 Applicant Action Item Responses for BWRVIP-18 - BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(1) The license renewal applicant is to verify that its plant is bounded by the report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP-18 report to manage the effects of aging on the functionality of the core spray internals during the period of extended operation. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the AMP within the BWRVIP-18 report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor pressure vessel components or other information presented in the report, such as materials of construction, will have to be identified by the LR applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	MNGP participates in the BWRVIP. This BWRVIP is applicable to MNGP and MNGP has confirmed that this BWRVIP bounds the MNGP design. The programs described as necessary to manage the effects of aging on the functionality of the RVP components are summarized in Table 4-1 of BWRVIP-74-A. MNGP commitments to the various programs required by this BWRVIP are included in Table B1.6-11.
(2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those applicants for license renewal referencing the BWRVIP-18 report for the core spray internals shall ensure that the programs and activities specified as necessary in the BWRVIP-18 report are summarily described in the FSAR supplement.	The MNGP USAR supplement, Appendix A of this LRA, includes a summary description of the programs and activities as required in the AAI.

Table B1.6-2 Applicant Action Item Responses for BWRVIP-18 - BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(3) 10 CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. In its Appendix C to the BWRVIP-18 report, the BWRVIP stated that there are no generic changes or additions to technical specification associated with the core spray internals as a result of its aging management review and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing the BWRVIP-18 report for the core spray internals shall ensure that the inspection strategy described in the BWRVIP-18 report does not conflict or result in any changes to their technical specifications. If technical specification changes do result, then the applicant should ensure that those changes are included in its application for license renewal.	No technical specification changes are required for the inspection strategy described in the BWRVIP-18 report.
(4) Applicants referencing the BWRVIP-18 report for license renewal should identify and evaluate any potential TLAA issues which may impact the structural integrity of the subject RPV internal components. This is discussed in more detail in Section 2.4 of this SE.	No TLAA issues were identified for the RPV internal Core Spray Components.

Table B1.6-3 Applicant Action Item Responses for BWRVIP-25 - BWR Core Plate Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(1) The license renewal applicant is to verify that its plant is bounded by the BWRVIP-25 report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP-25 report to manage the effects of aging on the functionality of the core plate assembly during the period of extended operation. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the AMP within the BWRVIP-25 report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	MNGP participates in the BWRVIP. This BWRVIP is applicable to MNGP and MNGP has confirmed that this BWRVIP bounds the MNGP design. The programs described as necessary to manage the effects of aging on the functionality of the RVP components are summarized in Table 4-1 of BWRVIP-74-A. Commitments to the various programs required by this BWRVIP are included in Table B1.6-11.
(2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those LR applicants referencing the BWRVIP-25 report for the core plate will ensure that the programs and activities specified as necessary in the BWRVIP-25 report are summarily described in the FSAR supplement.	The MNGP USAR supplement, Appendix A of this LRA, includes a summary description of the programs and activities as required in the AAI.

Table B1.6-3 Applicant Action Item Responses for BWRVIP-25 - BWR Core Plate Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(3) 10 CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. In its Appendix B to the BWRVIP-25 report, the BWRVIP stated that there are no generic changes or additions to technical specification associated with the core plate as a result of its AMR and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing the BWRVIP-25 report for the core plate will ensure that the inspection strategy described in the BWRVIP-25 report does not conflict or result in any changes to their technical specifications (TS). If TS changes do result, then the applicant should ensure that those changes are included in its application for license renewal.	No technical specification changes are required for the inspection strategy described in the BWRVIP-25 report.
(4) Due to susceptibility of the rim hold-down bolts to stress relaxation, applicants referencing the BWRVIP-25 report for license renewal should identify and evaluate the projected stress relaxation as a potential TLAA issue.	Rim hold-down bolts have been evaluated for loss of preload as a TLAA. See Section 4.8 for a summary of this evaluation.
(5) Until such time as an expanded technical basis for not inspecting the hold-down bolts is approved by the staff, applicants referencing the BWRVIP-25 report for license renewal should continue to perform inspections of the rim hold-down bolts.	Rim hold-down bolts are inspected at the MNGP in accordance with the requirements of BWRVIP-25. Re-inspection strategy is based on plant-specific analyses to assure that the critical number of bolts is intact to prevent lateral displacement of the core. These inspections are performed coincident with the shroud inspection schedule (10 year interval).

Table B1.6-4 Applicant Action Item Responses for BWRVIP-26-A - BWR Top Guide Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(1) The license renewal applicant is to verify that its plant is bounded by the topical report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP-26 report to manage the effects of aging on the functionality of the top guide structure during the period of extended operation. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the AMP within the BWRVIP-26 report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	MNGP technical personnel participate in the BWRVIP. This BWRVIP is applicable to MNGP and this BWRVIP bounds the MNGP design. The programs described as necessary to manage the effects of aging on the functionality of the RVP components are summarized in Table 4-1 of BWRVIP-74-A. Commitments to the various programs required by this BWRVIP are included in Table B1.6-11.
(2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those LR applicants referencing the BWRVIP-26 report for the top guide system shall ensure that the programs and activities specified as necessary in the BWRVIP-26 report are summarily described in the FSAR supplement.	The MNGP USAR supplement, Appendix A of this LRA, includes a summary description of the programs and activities as required in the AAI.

Table B1.6-4 Applicant Action Item Responses for BWRVIP-26-A - BWR Top Guide Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(3) 10 CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. In its Appendix C to the BWRVIP-26 report, the BWRVIP stated that there are no generic changes or additions to technical specification associated with the top guide as a result of its AMR and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing the BWRVIP-26 report for the top guide shall ensure that the inspection strategy described in the BWRVIP-26 report does not conflict or result in any changes to their TS. If TS changes do result, then the applicant should ensure that those changes are included in its application for license renewal.	No technical specification changes are required for the inspection strategy described in the BWRVIP-26 report.
(4) Due to IASCC of the subject safety-related components, applicants referencing the BWRVIP-26 report for license renewal should identify and evaluate the projected accumulated neutron fluence as a potential TLAA issue. This issue is discussed in more detail in Section 3.5 of this report.	IASCC of safety-related components has been evaluated for the MNGP. Three components have been identified as being susceptible to IASCC for the period of extended operation: the top guide, shroud, and incore instrumentation dry tubes and guide tubes. See Section 4.4 for a discussion of this TLAA.

Table B1.6-5 Applicant Action Item Responses for BWRVIP-27-A - BWR Standby Liquid Control System/Core Plate DP Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(1) The license renewal applicant is to verify that its plant is bounded by the report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP report to manage the effects of aging on the functionality of the DP/SLC vessel penetration/nozzle and safe-end extensions during the period of extended operation. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the aging management programs within this BWRVIP report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	The MNGP technical staff participates in the BWRVIP. This BWRVIP is applicable to MNGP and this BWRVIP bounds the MNGP design. The programs described as necessary to manage the effects of aging on the functionality of the RVP components are summarized in Table 4-1 of BWRVIP-74-A. Commitments to the various programs required by this BWRVIP are included in Table B1.6-11.
(2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those applicants for license renewal referencing the BWRVIP-27 report for the DP/SLC vessel penetration/nozzle and safe end extensions shall ensure that the programs and activities specified as necessary in the BWRVIP-27 document are summarily described in the FSAR supplement.	The MNGP USAR supplement, Appendix A of this LRA, includes a summary description of the programs and activities as required in the AAI.

Table B1.6-5 Applicant Action Item Responses for BWRVIP-27-A - BWR Standby Liquid Control System/Core Plate DP Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(3) 10 CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. In its Appendix B to the BWRVIP-27 report, the BWRVIP stated that there are no generic changes or additions to technical specification associated with the DP/SLC vessel penetration/nozzle and safe end extensions as a result of its aging management review and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing BWRVIP-27 for the DP/SLC vessel penetration/nozzle and safe end extensions shall ensure that the inspection strategy described in the BWRVIP-27 report does not conflict or result in any changes to their technical specifications. If technical specification changes do result, then the applicant should ensure that those changes are included in its application for license renewal.	No technical specification changes are required for the inspection strategy described in the BWRVIP-27 report.
(4) Due to the susceptibility of the subject components to fatigue, applicants referencing the BWRVIP-27 report for license renewal should identify and evaluate the projected fatigue cumulative usage factors as a potential TLAA issue. TLAA is discussed in more detail in Section 3.5 of this report.	RPV internals fatigue has been evaluated at the MNGP as a TLAA. These components are not limiting. See Section 4.3.2 for the disposition of this TLAA.

Table B1.6-6 Applicant Action Item Responses for BWRVIP-38 - BWR Shroud Support Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(1) The license renewal applicant is to verify that its plant is bounded by the topical report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP-38 report to manage the effects of aging on the functionality of the shroud support components during the period of extended operation, including actions planned to inspect welds that are presently inaccessible. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the aging management programs within the BWRVIP-38 report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	The MNGP technical staff participates in the BWRVIP. This BWRVIP is applicable to MNGP and this BWRVIP bounds the MNGP design. The programs described as necessary to manage the effects of aging on the functionality of the RVP components are summarized in Table 4-1 of BWRVIP-74-A. Commitments to the various programs required by this BWRVIP are included in Table B1.6-11.
(2) An FSAR supplement is required by 10 CFR 54.21 (d) for the facility and must contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those applicants for license renewal referencing the BWRVIP-38 report for the shroud support shall ensure that the programs and activities specified as necessary in the BWRVIP-38 report are summarily described in the FSAR supplement.	The MNGP USAR supplement, Appendix A of this LRA, includes a summary description of the programs and activities as required in the AAI.

Table B1.6-6 Applicant Action Item Responses for BWRVIP-38 - BWR Shroud Support Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(3) Each application for license renewal is required by 10 CFR 54.22 to include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. In its Appendix B to the BWRVIP-38 report, the BWRVIP stated that there are no generic changes or additions to technical specification associated with the shroud support as a result of its aging management review and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing the BWRVIP-38 report for the shroud support shall ensure that the inspection strategy described in the BWRVIP-38 report does not conflict or result in any changes to their technical specifications. If technical specification changes do result, then the applicant should ensure that those changes are included in its application for license renewal.	No technical specification changes are required for the inspection strategy described in the BWRVIP-38 report.

Table B1.6-7 Applicant Action Item Responses for BWRVIP-41 - BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(1) The license renewal applicant is to verify that its plant is bounded by the BWRVIP-41 report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP-41 report to manage the effects of aging on the functionality of the jet pump components during the period of extended operation, including actions planned to mitigate the issue concerning the inspection of welds that are presently inaccessible and the thermal and/or neutron embrittlement TLAA. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the aging management programs within the BWRVIP-41 report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	The MNGP technical staff participates in the BWRVIP. This BWRVIP is applicable to MNGP and bounds the MNGP design. The programs described as necessary to manage the effects of aging on the functionality of the RVP components are summarized in Table 4-1 of BWRVIP-74-A. Commitments to the various programs required by this BWRVIP are included in Table B1.6-11.
(2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those applicants for license renewal referencing the BWRVIP-41 report for the jet pump components shall ensure that the programs and activities specified as necessary in the BWRVIP-41 report are summarily described in the FSAR supplement.	The MNGP USAR supplement, Appendix A of this LRA, includes a summary description of the programs and activities as required in the AAI.

Table B1.6-7 Applicant Action Item Responses for BWRVIP-41 - BWR Jet Pump Assembly Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(3) 10 CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. In its Appendix A to the BWRVIP-41 report, the BWRVIP stated that there are no generic changes or additions to technical specification associated with the jet pump assembly as a result of its aging management review and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing the BWRVIP-41 report for the jet pump assembly shall ensure that the inspection strategy described in the BWRVIP-41 report does not conflict or result in any changes to their technical specifications. If technical specification changes do result, then the applicant should ensure that those changes are included in its application for license renewal.	No technical specification changes are required for the inspection strategy described in the BWRVIP-41 report.

Table B1.6-8 Applicant Action Item Responses for BWRVIP-47-A - BWR Lower Plenum Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(1) The LR applicant is to verify that its plant is bounded by the BWRVIP-47 report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP-47 report to manage the effects of aging on the functionality of the lower plenum during the period of extended operation. LR applicants will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the AMPs within the BWRVIP-47 report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	MNGP technical personnel participate in the BWRVIP. This BWRVIP is applicable to MNGP and bounds the MNGP design. The programs described as necessary to manage the effects of aging on the functionality of the RVP components are summarized in Table 4-1 of BWRVIP-74-A. Commitments to the various programs required by this BWRVIP are included in Table B1.6-11.
(2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those applicants for license renewal referencing the BWRVIP-47 report for the lower plenum shall ensure that the programs and activities specified as necessary in the BWRVIP-47 report are summarily described in the FSAR supplement.	The MNGP USAR supplement, Appendix A of this LRA, includes a summary description of the programs and activities as required in the AAI.

Table B1.6-8 Applicant Action Item Responses for BWRVIP-47-A - BWR Lower Plenum Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(3) 10 CFR 54.22 requires that each LR application include any TS changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the LR application. In its Appendix A to the BWRVIP-47 report, the BWRVIP stated that there are no generic changes or additions to technical specification associated with the lower plenum as a result of its AMR and that the applicant will provide the justification for plant-specific changes or additions. Those LR applicants referencing the BWRVIP-47 report for the lower plenum shall ensure that the inspection strategy described in the BWRVIP-47 report does not conflict or result in any changes to their TSs. If technical specification changes do result, then the applicant should ensure that those changes are included in its LR application.	No technical specification changes are required for the inspection strategy described in the BWRVIP-47 report.
(4) Due to fatigue of the subject safety-related components, applicants referencing the BWRVIP-47 report for LR should identify and evaluate the projected CUF as a potential TLAA issue. This issue is discussed in more detail in Section 3.5 of this report.	RPV internals fatigue has been evaluated for MNGP as a TLAA and found that these components are not limiting. See Section 4.3.2 for the disposition of this TLAA.

Table B1.6-9 Applicant Action Item Responses for BWRVIP-48-A - BWR Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(1) The license renewal applicant is to verify that its plant is bounded by the BWRVIP-48 report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP-48 report to manage the effects of aging on the functionality of the bracket attachments during the period of extended operation. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the aging management programs within the BWRVIP-48 report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	MNGP technical personnel participate in the BWRVIP. This BWRVIP is applicable to MNGP and bounds the MNGP design. The programs described as necessary to manage the effects of aging on the functionality of the RVP components are summarized in Table 4-1 of BWRVIP-74-A. Commitments to the various programs required by this BWRVIP are included in Table B1.6-11.
(2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those applicants for license renewal referencing the BWRVIP-48 report for the bracket attachments shall ensure that the programs and activities specified as necessary in the BWRVIP-48 report are summarily described in the FSAR supplement.	The MNGP USAR supplement, Appendix A of this LRA, includes a summary description of the programs and activities as required in the AAI.

Table B1.6-9 Applicant Action Item Responses for BWRVIP-48-A - BWR Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(3) 10 CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. In its Appendix A to the BWRVIP-48 report, the BWRVIP stated that there are no generic changes or additions to technical specification associated with the bracket attachments as a result of its aging management review and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing the BWRVIP-48 report for the bracket attachments shall ensure that the inspection strategy described in the BWRVIP-48 report does not conflict or result in any changes to their technical specifications. If technical specification changes do result, then the applicant should ensure that those changes are included in its LR application.	No technical specification changes are required for the inspection strategy described in the BWRVIP-48 report.

Table B1.6-10 Applicant Action Item Responses for BWRVIP-49-A - BWR Instrument Penetration Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(1) The license renewal applicant is to verify that its plant is bounded by the topical report. Further, the renewal applicant is to commit to programs described as necessary in the BWRVIP report to manage the effects of aging on the functionality of the reactor vessel instrument penetrations during the period of extended operation. Applicants for license renewal will be responsible for describing any such commitments and identifying how such commitments will be controlled. Any deviations from the aging management programs within this BWRVIP report described as necessary to manage the effects of aging during the period of extended operation and to maintain the functionality of the reactor vessel components or other information presented in the report, such as materials of construction, will have to be identified by the renewal applicant and evaluated on a plant-specific basis in accordance with 10 CFR 54.21(a)(3) and (c)(1).	MNGP technical personnel participate in the BWRVIP. This BWRVIP is applicable to MNGP and bounds the MNGP design. The programs described as necessary to manage the effects of aging on the functionality of the RVP components are summarized in Table 4-1 of BWRVIP-74-A. Commitments to the various programs required by this BWRVIP are included in Table B1.6-11.
(2) 10 CFR 54.21(d) requires that an FSAR supplement for the facility contain a summary description of the programs and activities for managing the effects of aging and the evaluation of TLAA for the period of extended operation. Those applicants for license renewal referencing the BWRVIP- 49 report for the instrument penetrations shall insure that the programs and activities specified as necessary in the BWRVIP-49 report are summarily described in the FSAR supplement.	The MNGP USAR supplement, Appendix A of this LRA, includes a summary description of the programs and activities as required in the AAI.

Table B1.6-10 Applicant Action Item Responses for BWRVIP-49-A - BWR Instrument Penetration Inspection and Flaw Evaluation Guidelines

Applicant Action Item Text	Plant-Specific Response
(3) 10 CFR 54.22 requires that each application for license renewal include any technical specification changes (and the justification for the changes) or additions necessary to manage the effects of aging during the period of extended operation as part of the renewal application. In its Appendix A to the BWRVIP-49 report, the BWRVIP stated that there are no generic changes or additions to technical specification associated with instrument penetrations as a result of its aging management review and that the applicant will provide the justification for plant-specific changes or additions. Those applicants for license renewal referencing BWRVIP-49 for the instrument penetrations shall ensure that the inspection strategy described in the BWRVIP-49 document does not conflict or result in any changes to their technical specifications. If technical specification changes do result, then the applicant should ensure that those changes are included in its application for license renewal.	No technical specification changes are required for the inspection strategy described in the BWRVIP-49 report.

Table B1.6-11 Responses to BWRVIP-74-A for the MNGP, Table 4-1 Inspection Items

BWRVIP-74-A Table 4-1 Item	MNGP LRA Reference AMP Description Section / Comments (see notes[a])
Circumferential Seam Welds	Section 4.2.6 / In accordance with GL 98-05 MNGP has received relief from inspection requirements for the 4th 10 year interval. Projected 64 EFPY fluence values and MNGP material chemistry values demonstrate that at the end of the license renewal period, the circumferential welds limiting conditional failure probability is bounded by the NRC analysis and is consistent with BWRVIP-74-A requirements.[b]
Vertical Seam Welds	Section 4.2.7 / Relief has not been requested for Vertical Seam Weld examination. Failure probability has been evaluated for the license renewal period and found to be bounded by the NRC analysis. MNGP manages the aging effects of the vertical seam welds in accordance with the requirements of the ASME Code, Section XI, Subsection IWB, Table IWB-2500-1 and Appendix VIII examinations as modified by 10 CFR 50.55a that have been shown to be equal to or surpass the guidance provided in Reg. Guide 1.150.
Full Penetration Nozzle Welds	Section A2.1.2 and Section B2.1.2 / MNGP manages the aging effects of the Full Penetration Nozzle Welds in accordance with the requirements of the ASME Code, Section XI, Subsection IWB, Table IWB-2500-1, Appendix VIII examinations as modified by 10 CFR 50.55a that have been shown to be equal to or surpass the guidance provided in Reg. Guide 1.150, and NUREG-0619 as implemented by incorporation of the recommendations of GENE-523-A71-0594-A, Revision 1 (Alternate BWR Feedwater Nozzle Inspection Requirements) for the feedwater nozzles to the MNGP ASME Section XI In-Service Inspection (ISI) Plan.
CRD Nozzle Welds	Section A2.1.2, Section A2.1.7, Section B2.1.2, and Section B2.1.7 / MNGP manages the aging effects of the CRD Nozzle Welds in accordance with the requirements of the ASME Code, Section XI, Subsection IWB, Table IWB2500-1 and BWRVIP-47 (Lower Plenum Inspection and Flaw Evaluation Guidelines). The CRD Return Line Nozzle has been capped and removed from service.
ICM Nozzle Welds	Section A2.1.2 and Section B2.1.2 / MNGP manages the aging effects of the ICM Nozzle Welds in accordance with the requirements of the ASME Code, Section XI, Subsection IWB, Table IWB2500-1 and BWRVIP-49 (Instrument Penetration Inspection and Flaw Evaluation Guidelines).

Table B1.6-11 Responses to BWRVIP-74-A for the MNGP, Table 4-1 Inspection Items

BWRVIP-74-A Table 4-1 Item	MNGP LRA Reference AMP Description Section / Comments (see notes[a])
SLC Nozzle Safe End Weld	Section A2.1.2 and Section B2.1.2 / MNGP manages the aging effects of the SLC Nozzle Safe End Welds in accordance with the requirements of the ASME Code, Section XI, Subsection IWB, Table IWB 2500-1 with augmented examination and frequency requirements of BWRVIP-27 (BWR Standby Liquid Control System/Core Plate DP Inspection and Flaw Evaluation Guidelines).
Safe End Welds	Section A2.1.2 and Section B2.1.2 / MNGP manages the aging effects of the Safe End Welds in accordance with the requirements of the ASME Code, Section XI, Subsection IWB, Table IWB 2500-1 and the MNGP Risk Informed - In-Service Inspection Program (ISI Relief Request #1, Monticello Nuclear Generating Plant - Risk Informed In-Service Inspection Program, approved July 24, 2002 - TAC MB3819).
Closure Head Studs	Section A2.1.28 and Section B2.1.28 / MNGP manages the aging effects of the Reactor Vessel Closure Head Studs in accordance with the requirements of the ASME Code, Section XI, Subsection IWB, Table IWB-2500-1.
Top Head Flange Bolts	Section A2.1.4 and Section B2.1.4 / MNGP manages the aging effects of the Top Head Flange Bolts in accordance with the requirements of the ASME Code, Section XI, Subsection IWB, Table IWB-2500-1.
Skirt and Stabilizer Attachment Welds	Section A2.1.2 and Section B2.1.2 / MNGP manages the aging effects of the Skirt and Stabilizer Attachment Welds in accordance with the requirements of the ASME Code, Section XI, Subsection IWB, Table IWB-2500-1.
Vessel Interior Surfaces	Section A2.1.2 and Section B2.1.2 / MNGP manages the aging effects of the Vessel Interior Surfaces in accordance with the requirements of the ASME Code, Section XI, Subsection IWB, Table IWB-2500-1.[c]
Shroud Support Attachment	Section A2.1.11 and Section B2.1.11 / MNGP manages the aging effects of the Shroud Support Attachments in accordance with BWRVIP-38 (BWR Shroud Support Inspection and Flaw Evaluation Guidelines), and the ASME Code, Section XI, Subsection IWB, Table IWB-2500-1.

Table B1.6-11 Responses to BWRVIP-74-A for the MNGP, Table 4-1 Inspection Items

BWRVIP-74-A Table 4-1 Item	MNGP LRA Reference AMP Description Section / Comments (see notes[a])
Core Spray Attachments	Section A2.1.11 and Section B2.1.11 / MNGP manages the aging effects of the Core Spray Attachments in accordance with BWRVIP-48 (Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines), BWRVIP-18 (Core Spray Internals Inspection and Flaw Evaluation Guidelines) and the ASME Code, Section XI, Subsection IWB, Table IWB-2500-1. The P1,2 & 3 welds are not inspected in accordance with BWRVIP-18 guidance. MNGP has installed mechanical clamps to insure the structural integrity of the sparger T-box. MNGP performs a visual inspection each outage to confirm that T-box integrity is maintained.
Riser Brace Attachments	Section A2.1.11 and Section B2.1.11 / MNGP manages the aging effects of the Jet Pump Riser Brace Attachments in accordance with BWRVIP-48 (Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines), BWRVIP-41 (BWR Jet Pump Assembly Inspection and Flaw Evaluation guidelines) and the ASME Code, Section XI, Subsection IWB, Table IWB-2500-1.
Dryer Support & FW Sparger Attachments	Section A2.1.11 and Section B2.1.11 / MNGP manages the aging effects of the Dryer Support and FW Sparger Attachments in accordance with BWRVIP-48 (Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines) and the ASME Code, Section XI, Subsection IWB, Table IWB-2500-1.
Other Vessel Interior Attachments	Section A2.1.11 and Section B2.1.11 / MNGP manages the aging effects of Vessel ID Attachment Welds in accordance with BWRVIP-48 (Vessel ID Attachment Weld Inspection and Flaw Evaluation Guidelines) and the ASME Code, Section XI, Subsection IWB, Table IWB-2500-1
Vessel Exterior Attachments - Skirt	Section A2.1.2 and Section B2.1.2 / MNGP manages the aging effects of the Vessel Exterior Skirt in accordance with the requirements of the ASME Code, Section XI, Subsection IWB, Table IWB-2500-1.
Vessel Exterior Attachments - Stabilizer Bracket	Section A2.1.2 and Section B2.1.2 / MNGP manages the aging effects of the Vessel Exterior Stabilizer Brackets in accordance with the requirements of the ASME Code, Section XI, Subsection IWB, Table IWB-2500-1.[d]
Vessel Exterior	Section A2.1.2 and Section B2.1.2 / MNGP manages the aging effects of the Vessel Exterior in accordance with the requirements of the ASME Code, Section XI, Subsection IWB, Table IWB-2500-1.

a.Table 11 Notes - The following notes identify relief requests, in addition to Relief Request No. 1 described above for safe end welds, which NMC has received approval for 4th interval implementation.

b.Circumferential Weld Examination Relief (NRC letter, Monticello Nuclear Generating Plant-Approval of Relief Request Number 12 for the Third 10 Year In-Service Inspection Program (TAC No. MB02061), dated July 27, 2001). Note: Implemented for 4th Interval by Relief Request No. 2, Revision 1 dated 5/21/2004, which addresses Generic Letter 98-05 requirements for permanent relief (limiting conditional failure probability and cold over-pressure).

c.Use of root-mean-square error calculations as opposed to statistical parameters for the clad/base metal interface of the reactor pressure vessel contained in Appendix VIII, of the 1995 Edition, 1996 Addenda of the ASME Code, Section XI (letter, NRC to NMC, Monticello Nuclear Generating Plant - Relief Request Nos. 3 and 6 for the Fourth 10-Year Interval of the In-Service Inspection Examination Plan (TAC No. MB6896), dated March 28, 2003).

d.Reduction in examination frequency (NRC letter, Monticello Nuclear Generating Plant-Fourth 10-Year In-Service Inspection Interval Request for Relief No. 4 (TAC No. C2222), dated January 6, 2005).

B1.7 Time Limited Aging Analyses Aging Management Programs:

The following NUREG-1801 Aging Management Programs support Time Limited Aging Analyses (TLAAs) described in Section 4.0.

1. Environmental Qualification (EQ) of Electrical Components [Section B3.1]
2. Metal Fatigue of Reactor Coolant Pressure Boundary [Section B3.2] Aging Management Programs Correlation

B2 AGING MANAGEMENT PROGRAMS CORRELATION

Correlation between NUREG-1801 programs and MNGP programs are shown below. For the MNGP Programs, links to appropriate sections of this appendix are provided.

NUREG-1801 PROGRAM NUMBER	NUREG-1801 PROGRAM	MNGP Program
NUREG-1801 Chapter X		
X.E1	Environmental Qualification (EQ) of Electrical Components	Environmental Qualification (EQ) of Electrical Components [Section B3.1]
X.M1	Metal Fatigue of Reactor Coolant Pressure Boundary	Metal Fatigue of Reactor Coolant Pressure Boundary [Section B3.2]
X.S1	Concrete Containment Tendon Prestress	Not credited for License Renewal at MNGP. MNGP uses a BWR Mark I steel containment.
NUREG-1801 Chapter XI		
XI.E1	Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements [Section B2.1.15]
XI.E2	Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrument Circuits	Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrument Circuits [Section B2.1.16]

NUREG-1801 PROGRAM NUMBER	NUREG-1801 PROGRAM	MNGP Program
XI.E3	Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements [Section B2.1.21]
XI.M1	ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD	ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD [Section B2.1.2]
XI.M2	Water Chemistry	Plant Chemistry Program [Section B2.1.25]
XI.M3	Reactor Head Closure Studs	Reactor Head Closure Studs [Section B2.1.28]
XI.M4	BWR Vessel ID Attachment Welds	BWR Vessel ID Attachment Welds [Section B2.1.11]
XI.M5	BWR Feedwater Nozzle	BWR Feedwater Nozzle [Section B2.1.8]
XI.M6	BWR Control Rod Drive Return Line Nozzle	BWR Control Rod Drive Return Line Nozzle [Section B2.1.7]
XI.M7	BWR Stress Corrosion Cracking	BWR Stress Corrosion Cracking [Section B2.1.10]
XI.M8	BWR Penetrations	BWR Penetrations [Section B2.1.9]
XI.M9	BWR Vessel Internals	BWR Vessel Internals [Section B2.1.12]

NUREG-1801 PROGRAM NUMBER	NUREG-1801 PROGRAM	MNGP Program
XI.M10	Boric Acid Corrosion	This Program is not credited for License Renewal at the MNGP. This Program monitors the condition of the reactor coolant pressure boundary for borated water leakage. This condition is for PWRs. MNGP is a BWR, therefore the program is not applicable.
XI.M11	Nickel-Alloy Nozzles & Penetrations	Not credited for License Renewal. Not used at MNGP.
XI.M12	Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)	This program is not credited for License Renewal at MNGP. This program inspects cast austenitic stainless steel (CASS) components to detect the effects of loss of fracture toughness due to thermal aging embrittlement. There are no MNGP piping components that meet the NUREG-1801 report screening criteria for susceptibility to thermal aging embrittlement. Since pump casings and valve bodies are excluded from this program, the only remaining CASS components are within the vessel internals, which are addressed in the NUREG-1801 XI.M13 program [Section B2.1.33]. Therefore, the NUREG-1801 XI.M12 program is not required for MNGP.

NUREG-1801 PROGRAM NUMBER	NUREG-1801 PROGRAM	MNGP Program
XI.M13	Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)	Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) [Section B2.1.33]
XI.M14	Loose Part Monitoring	Not credited for License Renewal at MNGP. Reactor Vessel Internals Program [Section B2.1.12] was determined to be adequate to manage identified aging effects.
XI.M15	Neutron Noise Monitoring	This program is not credited for License Renewal at the MNGP. This program monitors the excore neutron detector signals in pressurized water reactors (PWRs). Because MNGP is a BWR, this program is not applicable.
XI.M16	PWR Vessel Internals	This program is not credited for License Renewal at the MNGP. This program ensures the long-term integrity and safe operation of pressurized water reactor (PWR) vessel internal components, utilizing EPRI guidance for PWRs. MNGP is a BWR; therefore, this program is not applicable to MNGP.
XI.M17	Flow-Accelerated Corrosion	Flow-Accelerated Corrosion [Section B2.1.19]
XI.M18	Bolting Integrity	Bolting Integrity [Section B2.1.4]

NUREG-1801 PROGRAM NUMBER	NUREG-1801 PROGRAM	MNGP Program
XI.M19	Steam Generator Tube Integrity	This program is not credited for License Renewal at the MNGP. This program manages the effects of aging on steam generator tubes for pressurized water reactors (PWRs). Because MNGP is a BWR, this program is not applicable.
XI.M20	Open-Cycle Cooling Water System	Open-Cycle Cooling Water System [Section B2.1.24]
XI.M21	Closed-Cycle Cooling Water System	Closed-Cycle Cooling Water System [Section B2.1.13]
XI.M22	Boraflex Monitoring	This program is not credited for License Renewal at the MNGP. This program manages the effects of aging on Boraflex panels in spent fuel racks. Because MNGP does not have Boraflex panels installed in the spent fuel racks, this program is not applicable.
XI.M23	Inspection of Overhead Heavy Load & Light Load (Related to Refueling) Handling Systems	Inspection of Overhead Heavy Load & Light Load (Related to Refueling) Handling Systems [Section B2.1.22]
XI.M24	Compressed Air Monitoring	Compressed Air Monitoring [Section B2.1.14]

NUREG-1801 PROGRAM NUMBER	NUREG-1801 PROGRAM	MNGP Program
XI.M25	BWR Reactor Water Cleanup System	This program is not credited for License Renewal at MNGP. Aging effects of the MNGP BWR Reactor Water Cleanup System are adequately managed by the MNGP ASME Section XI In-Service Inspection Program.
XI.M26	Fire Protection	Fire Protection [Section B2.1.17]
XI.M27	Fire Water System	Fire Water System [Section B2.1.18]
XI.M28	Buried Piping & Tanks Surveillance	This program is not credited for License Renewal at MNGP. This program includes preventive measures to mitigate corrosion of buried carbon steel piping and tanks. MNGP adequately manages this aging effect by its Buried Piping & Tanks Inspection Program [Section B2.1.5] and thus does not require an additional Buried Piping and Tanks Surveillance Program.
XI.M29	Above Ground Carbon Steel Tanks	This program is not credited for License Renewal at MNGP. MNGP does not have any exterior above ground carbon steel tanks within the scope of License Renewal.
XI.M30	Fuel Oil Chemistry	Fuel Oil Chemistry [Section B2.1.20]
XI.M31	Reactor Vessel Surveillance	Reactor Vessel Surveillance [Section B2.1.29]

NUREG-1801 PROGRAM NUMBER	NUREG-1801 PROGRAM	MNGP Program
XI.M32	One-Time Inspection	One-Time Inspection Program [Section B2.1.23]
XI.M33	Selective Leaching Of Materials	Selective Leaching Of Materials [Section B2.1.30]
XI.M34	Buried Piping and Tank Inspection	Buried Piping & Tanks Inspection [Section B2.1.5]
XI.S1	ASME Section XI, Subsection IWE	Primary Containment In-Service Inspection Program [Section B2.1.26]
XI.S2	ASME Section XI, Subsection IWL	This program is not credited for License Renewal at MNGP. This program manages aging of reinforced and prestressed concrete containments, and unbonded post-tensioning systems. Because MNGP does not have this type of containment, this program is not applicable.
XI.S3	ASME Section XI, Subsection IWF	ASME Section XI, Subsection IWF [Section B2.1.3]
XI.S4	10 CFR 50, Appendix J	10 CFR 50, Appendix J [Section B2.1.1]
XI.S5	Masonry Wall Program	Program is included in Structures Monitoring Program [Section B2.1.31]
XI.S6	Structures Monitoring Program	Structures Monitoring Program [Section B2.1.31]
XI.S7	RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants	Program is included in Structures Monitoring Program [Section B2.1.31]

NUREG-1801 PROGRAM NUMBER	NUREG-1801 PROGRAM	MNGP Program
XI.S8	Protective Coating Monitoring & Maintenance Program	Protective Coating Monitoring & Maintenance Program [Section B2.1.27]
Plant Specific Programs		
NA	Plant-Specific Program	Bus Duct Inspection Program [Section B2.1.6]
NA	Plant-Specific Program	System Condition Monitoring Program [Section B2.1.32]

B2.1 Aging Management Program Details

B2.1.1 10 CFR 50, Appendix J

Program Description

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. This risk and performance based approach to testing provides reasonable assurance that developing leakage is detected and corrected well before it reaches a magnitude that could compromise containment function.

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.

NUREG-1801 Consistency

The MNGP 10 CFR 50, Appendix J Program is an existing program. With exceptions, it is consistent with the recommendations of NUREG-1801, Chapter XI, Program XI.S04.

Exceptions to NUREG-1801

The program takes exceptions for NRC approved exemptions from the requirements of 10 CFR 50, Appendix J. For further details, see the following element discussions of the exceptions to NUREG-1801 aging management program elements:

- Scope of Program

  Main steam isolation valves are tested at 25 psig instead of at an accident pressure of 42 psig. This represents an NRC approved exception (letter from Darrell G. Eisenhut, NRC to D. M. Musolf, NSP; Docket No 50-263; June 3, 1984) to the 10 CFR 50, Appendix J requirement that leakage tests be conducted at accident pressure.

- Monitoring and Trending

  Type A test interval extended, on a one-time basis, to 15 years, which exceeds the 10-year limit on interval given in NEI 94-01. This represents an NRC approved exception to the NEI 94-01 requirement that Type A leakage tests be conducted at an interval not to exceed 10 years.

Enhancements

None.

Aging Management Program Elements

The elements, which are part of the 10 CFR 50, Appendix J Program are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.S04, 10 CFR Part 50, Appendix J, are also provided.

Scope of Program

The 10 CFR 50, Appendix J Program prescribes pressure tests to monitor leakage through the primary containment pressure-retaining boundary and through individual penetration isolation barriers. It also prescribes visual examination of accessible drywell and torus shell surfaces. The program detects and manages the loss of material, cracking, fretting, lockup and loss of leak tightness aging effects that can result in containment leakage as well as those that can be detected by visual examination. An NRC approved exception (Letter from Darrell G. Eisenhut, NRC to D. M. Musolf, NSP; Docket No 50-263; 03 Jun 84) allows a reduction in main steam isolation valve test pressure from 42 psig to 25 psig.

The 10 CFR 50, Appendix J Program manages the aging effects for components of the following systems and structures:

Primary Containment

Preventive Actions

The 10 CFR 50, Appendix J Program is a monitoring program. Preventive actions are not a part of the program.

Parameters Monitored or Inspected

The 10 CFR 50, Appendix J Program monitors leakage through the overall containment pressure boundary and through individual penetration isolation barriers. It also monitors, through visual examination, the physical condition of accessible containment surfaces.

Detection of Aging Effects

The 10 CFR 50, Appendix J Program detects aging effects principally by tests that measure leakage through the overall containment pressure boundary and through individual penetration isolation barriers. These tests detect through wall corrosion, through wall cracks, resilient seal deterioration, air lock mechanism wear and loss of preload in pressure retaining bolting. The tests also detect valve seat deterioration, a mechanism that is not within the scope of license renewal aging management.

Visual examinations required by the program detect corrosion and other deterioration visible on accessible containment surfaces.

Monitoring and Trending

The 10 CFR 50, Appendix J Program specifies periodic tests that monitor leak tight integrity throughout the service lifetime of the containment system.

Leakage tests are done on a regular basis and leakage trends are evaluated. Intervals between leakage tests are based on evaluation of the leakage trends as well as risk considerations. Current maximum intervals are: 15 years for the Type A test (an approved exception to the ten-year limit endorsed through reference by 10 CFR 50, Appendix J, Option B); ten years for most Type B tests;

and five years for most Type C tests. The maximum interval applicable to the personnel air lock, as well as to the main steam, feed water, and purge isolation valves, is 30 months.

Acceptance Criteria

Leakage limits are established for both plant startup and operation. Limits include total containment as-found leakage, total containment as-left leakage, and total summed leakage from specific identified pathways. Limits meet the requirements of 10 CRF 50 Appendix J and are contained in Technical Specifications as part of the current licensing basis. Limits are established in terms of a total allowable containment leakage L_a (volume percent per day criterion).

Corrective Actions

Test results that exceed established leakage limits are documented and evaluated through the Corrective Action Program for cause and required repairs. Consistent with 10 CFR 50, Appendix J, Option B, corrective actions can require increased frequency testing to confirm acceptable performance has been reestablished.

Refer also to Section B1.3.

Confirmation Process

Test results that exceed established limits are documented and evaluated through the Corrective Action Program for cause and required repairs. Post maintenance testing is performed to confirm corrective actions restored the leakage pathway(s) to acceptable limits. Increased frequency testing may be required to confirm acceptable performance has been reestablished.

Refer also to Section B1.3.

Administrative Controls

Test results that do not meet leakage limits are evaluated in the Corrective Action Program. Consistent with 10 CFR 50, Appendix J, test results that do not meet Technical Specification limits are reported in accordance with the applicable requirements of 10 CFR 50.72 and 10 CFR 50.73. Test results are documented in a standardized report that includes previous cycle results consistent with the record keeping requirements of 10 CFR 50, Appendix J, Option B.

Refer also to Section B1.3.

Operating Experience

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

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 the aging management program. 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. As a result, the 10 CFR 50, Appendix J Program is demonstrated to be an effective aging management tool.

MNGP is committed to the risk and performance based program defined by 10CFR50, Appendix J, Option B. This approach uses plant and industry wide operating experience as the bases for defining the performance & 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.

MNGP is committed to a performance based leakage-testing program that utilizes both plant and industry wide operating experience to establish testing requirements.

Conclusion

Implementation of the MNGP 10 CFR 50, Appendix J Program will provide reasonable assurance that aging effects will be managed so that the structures and structural components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.2 ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD

Program Description

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, Rev. 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 (TAC NO. MB3819).

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

The Plant Chemistry Program augments this program where applicable.

NUREG-1801 Consistency

The Monticello Nuclear Generating Plant ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program is an existing program. With exceptions, it is consistent with the recommendations of NUREG-1801, Chapter XI, Program XI.M1.

Exceptions to ASME Code requirements that have been granted by approved Code Cases or relief requests, or modifications by 10 CFR 50.55(a) are not considered to be exceptions to NUREG-1801 criteria.

Exceptions to NUREG-1801

This subsection identifies the elements of the MNGP AMP that are not consistent with the corresponding NUREG-1801 AMP elements.

See the following element discussion(s) on the exceptions to NUREG-1801 aging management program elements:

- Scope

  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.

Per 10 CFR 50.55a(b)(2)(xxi)(B), reused 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.

Enhancements

None.

Aging Management Program Elements

The program elements, which are part of the MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M1, ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD, are also provided.

Scope of Program

The scope of the MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program is part of the MNGP In-Service Inspection Program and provides for condition monitoring of Class 1, 2, and 3 pressure-retaining components and their integral attachments. The scope of the program includes the requirements for In-Service inspection, pressure testing, and repair/replacement activities in accordance with ASME Section XI and risk-informed in-service inspection methodology.

The MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program manages the aging effects for components within License Renewal scope.

Reactor coolant piping welds less than 4 inches Nominal Pipe Size (NPS) are examined on the inside surface for service induced weld cracking in accordance with the MNGP Aging Management Program One-Time Inspection.

The following program exceptions to NUREG-1801 regarding scope are being implemented in accordance with 10 CFR 50.55a:

- 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.
- Additionally, per 10 CFR 50.55a(b)(2)(xxi)(B), reused 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 MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program, manages aging effects for components of the following License Renewal systems and structures:

Core Spray	Reactor Recirculation
Reactor Head Vent	Residual Heat Removal
Reactor Pressure Vessel	Reactor Vessel Instrumentation
Reactor Pressure Vessel Internals	

Preventive Actions

The MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program is a condition monitoring program that detects degradation of components before the loss of intended function. Therefore, there are no preventive or mitigating attributes that are associated with these activities.

Parameters Monitored or Inspected

The requirements of the ASME Section XI Tables IWB-2500-1, IWC-2500-1, and IWD-2500-1 for Class 1, 2, and 3 components and integral attachments with RI-ISI methodology for Class 1 or 2 piping are incorporated into the MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program. The aging management parameters that are monitored/inspected are crack initiation and growth and reduction of fracture toughness.

This program is a condition monitoring program that detects and sizes flaws and defects by implementing the examination and inspection requirements of ASME Section XI, Subsections IWA, IWB, IWC, and IWD and/or RI-ISI methodology.

Detection of Aging Effects

The MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program prescribes the detection of aging effects in accordance with the requirements of ASME Section XI and/or the NRC approved Risk-Informed ISI Program to ensure that aging effects will be discovered and repaired before the loss of intended function. The program uses three types of examination - visual, surface, and volumetric - in accordance with the general requirements of Subsection IWA-2000 to determine the general mechanical and structural condition of the Class 1, 2, and 3 components, and their integral attachments. 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 and/or RI-ISI methodology. The extent and schedule of the examinations are rigorously identified within the ISI program.

Monitoring and Trending

The monitoring and trending of Class 1, 2, and 3 components and their integral attachments is prescribed by the MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program. The program requirements for inspection schedule, extent, frequency, sequence of examinations, re-examinations, and additional examinations are in accordance with ASME Section XI, Subsections IWB, IWC, and IWD and the NRC approved Risk Informed ISI program.

Acceptance Criteria

The MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program prescribe the acceptance criteria for Class 1, 2, and 3 components and their integral attachments. The program requirements for acceptance, rejection, and analytical evaluation are in accordance with ASME Section XI, Subsections IWB, IWC, and IWD.

The reactor vessel internals are controlled by the BWR Vessel Internals Program in accordance with NUREG-1801, Chapter XI, Program XI.M9, "BWR Vessel Internals" and addresses the use of BWRVIP-14, BWRVIP-59, and BWRVIP-60.

Corrective Actions

For Class 1, 2, and 3, respectively, repair and replacements are in conformance with IWA-4000 and approved NRC relief requests. Approved BWRVIP-44 and BWRVIP-45 documents, respectively, provide guidelines for weld repair of nickel alloys and for weldability of irradiated structural components.

Also refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

A review of operating experience for the MNGP 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. Adequate corrective actions were taken to prevent recurrence. The MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program effectively monitors the condition of the pressure retaining components within the License Renewal (LR) boundary and ensures aging effects are acceptably managed. Appropriate guidance is contained in MNGP procedures for indications of degradation requiring re-evaluation, repair, or replacement.

Periodic self-assessments and reviews of industry and plant experience are performed to identify any areas needing improvement. Some examples follow:

- MNGP substantially 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 Reg. 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 in the other screws. Further re-inspections will follow as warranted by conditions.
- 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. Inspectors believed incomplete fusion may have played a role in the failures. 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 review of operating experience indicates the MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program is effective in detecting and trending degradation and taking effective corrective actions as needed when acceptance criteria are not met. In addition, self-assessments have been effective in improving program effectiveness.

Conclusion

Implementation of the MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.3 ASME Section XI, Subsection IWF

Program Description

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.

NUREG-1801 Consistency

The ASME Section XI, Subsection IWF Program is an existing program. It will be enhanced to be consistent with the NUREG-1801, Chapter XI, Program XI.S3 and ASME Section XI, Subsection IWF.

Exceptions to NUREG-1801

None.

Enhancements

The following enhancement is required to satisfy the NUREG-1801 aging management program recommendations. Details of the enhancement are included in the appropriate element description below. Enhancements are scheduled for implementation prior to the period of extended operation.

- Scope of Program

  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.

Aging Management Program Elements

The program elements, which are part of the MNGP ASME Section XI, Subsection IWF Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI Program XI.S3, ASME Section XI, Subsection IWF, are also provided.

Scope of Program

The scope of the MNGP ASME Section XI, Subsection IWF Program, in accordance with 10CFR50.55a, is part of the MNGP ASME Section XI In-Service Inspection Program and provides for condition monitoring of Class 1, 2, 3, and MC component supports in accordance with the applicable ASME Section XI requirements and Table IWF-2500-1.

The MNGP ASME Section XI, Subsection IWF Program will be enhanced to provide inspections of Class MC component supports consistent with NUREG-1801, Chapter III, Section B1.3.

The MNGP ASME Section XI In-Service Inspection, Subsections IWB, IWC, and IWD Program manages aging effects for the following License Renewal systems and structures:

Hangers and Supports

Preventive Actions

The MNGP ASME Section XI, Subsection IWF Program is a condition monitoring program that detects degradation of components before loss of intended function. There are no preventive or mitigating attributes that are associated with these activities.

Parameters Monitored or Inspected

The aging effect parameters that are monitored/inspected with the MNGP ASME Section XI, Subsection IWF Program are loss of material and loss of mechanical function. The ASME Section XI, Subsection IWF Program is a condition monitoring program that detects unacceptable conditions by implementing the examination and inspection requirements of ASME Section XI, the MNGP Technical Specifications, and 10 CFR 50.55a.

Detection of Aging Effects

The detection of aging effects is prescribed by the MNGP ASME Section XI, Subsection IWF Program in accordance with the requirements of ASME Section XI to ensure that aging effects will be discovered and repaired before the loss of intended function. The nondestructive detection technique used is the VT-3 visual examination method to detect unacceptable conditions such as loss of material and loss of mechanical function. The extent, schedule, technique, and personnel qualifications for the examinations are rigorously identified within the program.

Monitoring and Trending

The MNGP ASME Section XI, Subsection IWF Program, prescribes the monitoring and trending of Class 1, 2, 3, and MC component supports. The program requirements for inspection schedule, extent, frequency, sequence of examinations, re-examinations, and additional examinations are in accordance with ASME Section XI, Article IWF-2000.

Acceptance Criteria

The acceptance criteria for Class 1, 2, 3, and MC component supports is prescribed by the MNGP ASME Section XI, Subsection IWF Program. The program requirements for acceptance, rejection, and analytical evaluation or test are in accordance with ASME Section XI, Article IWF-3000.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

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.

This program has demonstrated on several occasions that it provides reasonable assurance that aging effects are being managed for Class 1, 2, 3, and MC component supports susceptible to loss of material and loss of mechanical function. This has been verified by review of NRC inspection reports, INPO evaluations, audits, self-assessments, and the Corrective Action Program. 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.

Conclusion

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

B2.1.4 Bolting Integrity

Program Description

The Bolting Integrity Program manages the aging affects 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:

- 10 CFR 50, Appendix J,

- ASME Section XI In-Service Inspection, Subsections IWB, IWC and IWD,
- Primary Containment In-Service Inspection,
- Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems,
- ASME Section XI, Subsection IWF,
- Buried Piping and Tanks Inspection,
- Bus Duct Inspection,
- BWR Vessel Internals,
- Reactor Head Closure Studs Monitoring,
- System Condition Monitoring, and
- Structures Monitoring.

NUREG-1801 Consistency

The MNGP Bolting Integrity Program is an existing program. It will be enhanced to be consistent with the recommendations of NUREG-1801, Chapter XI, Program XI.M18.

Exceptions to NUREG-1801

None.

Enhancements

The following enhancement(s) are required to satisfy the NUREG-1801 aging management program recommendations. Details of the enhancements are included in the appropriate element descriptions below. Enhancements are scheduled for completion prior to the period of extended operation.

- Parameters Monitored or Inspected, and Acceptance Criteria

  The guidance for performing visual bolting inspections contained in EPRI TR-104213, Bolted Joint Maintenance & Application Guide, and the Good Bolting Practices Handbook (EPRI NP-5067 Volumes 1 and 2) will be included in the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program, Structures Monitoring Program and System Condition Monitoring Program.

Aging Management Program Elements

The elements, which are part of the MNGP Bolting Integrity Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M18, “Bolting Integrity” are also provided.

Scope of Program

The Bolting Integrity Program manages the aging affects associated with bolting through material selection and testing, bolting pre-load control, operation, maintenance and the performance of periodic inspections. The program also includes repair and replacement controls and requirements on the selection of thread lubricants, consideration of lubricant use on torque determinations, and assembly requirements (bolting/torque patterns).

Material selection and control, receipt inspection, bolting assembly and pre-load control, and other requirements are contained within the Bolting Integrity Program. However, the program credits other MNGP Aging Management Programs for inspection activities for installed bolts and for a few of the repair and replacement activities. The scope of the credited programs is:

- The 10 CFR 50, Appendix J Program provides the requirements for pneumatic pressure tests and visual examinations to verify the structural and leak tight integrity of the primary containment and includes testing of bolted containment penetrations.
- The ASME Section XI In-Service Inspection, Subsections IWB, IWC and IWD Program provides the requirements for in-service inspection of ASME Section XI, Class 1, 2, and 3 pressure retaining bolting.
- The Primary Containment In-service Inspection Program provides the requirements for 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 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program provides the requirements for visual examinations of bolting used as part of Cranes, Heavy Loads, Rigging System in license renewal scope.

- The ASME Section XI, Subsection IWF Program provides the requirements for inspection of ASME Section XI, Class 1, 2 and 3 component support bolting.
- The Buried Pipes and Tanks Inspection Program provides the requirements for the inspection of overall corrosion to underground piping, valves, fasteners and tanks.
- The Bus Duct Inspection Program provides the requirements for the inspection of bolting used on the Non-Segregated Phase Bus. Loosening of bolted connections due to thermal cycling is covered.
- The BWR Vessel Internals Program provides the requirements for inspection of bolting internal to the reactor vessel. Inspections are performed in accordance with ASME Section XI, Subsection IWB and enhanced examinations contained in BWRVIP-03, BWR Vessel and Internals Project, Reactor Pressure Vessel and Internals Examination Guidelines.
- The Reactor Head Closure Studs Monitoring Program provides for inspection of reactor head closure studs, material selection, and protective coatings. Nondestructive inspection techniques, including volumetric, surface, and visual examination are used to determine the general mechanical and structural condition of the reactor head closure studs.
- The System Condition Monitoring Program provides the requirements for the visual inspection of system bolting and component support bolting within the scope of license renewal that is not included in ASME Section XI inspections.
- The Structures Monitoring Program provides the requirements for the visual inspection of structural bolting within the scope of license renewal that is not included in ASME Section XI, Subsection IWF, inspections.

The technical basis for the Bolting Integrity Program includes consideration of the guidance contained in EPRI NP-5769, with exceptions and additional considerations as noted in NUREG-1339. This is based on meeting the following key elements of Section 3 of NUREG-1339:

- The Bolting Integrity Program is plant specific and considers both plant and industry operating experience,
- NRC clarifications, included in Section 3 of NUREG-1339 regarding the use of EPRI NP-5769, have been addressed at Monticello,
- NRC Information Notices, Bulletins, Circulars, and Generic Letters listed in Section 3 of NUREG-1339 have been evaluated and addressed, as

applicable, at Monticello. Some of these documents resulted in confirmatory analysis, inspections, or modifications and others in the addition of special items to consider in the procurement or design process,

- The recommendations and guidelines included in Section 1, Volume 2 of EPRI NP-5769 are part of the Bolting Integrity Program, and
- The findings of EPRI NP-5769, Volume 1, Section 2, relevant to leak tightness and use of thread lubricants have been addressed at Monticello. This includes assembly (bolt-up) practices, controlling the use of thread lubricants such as molybdenum disulphide based lubricants, and the use of the EPRI Good Bolting Practices Handbook (EPRI NP-5067 Volumes 1 and 2).

For other bolting, the technical basis for the Bolting Integrity Program includes consideration of the guidance in EPRI TR-104213. EPRI TR-104213 was used in the establishment of bolting assembly and torque requirements. Bolt material selection, control, and receipt inspection are consistent with guideline practices.

The Bolting Integrity Program manages the aging effects for bolting within the scope of license renewal. This includes both greater and smaller than 2 inches safety-related bolting, bolting for component supports, bolting for other pressure retaining components, and structural bolting for the following systems and/or structures:

Alternate Nitrogen Supply	Off Site Power / SBO Recovery Path
Automatic Pressure Relief	Off Gas Stack
Chemistry Sampling	Off Gas Storage and Compressor Building
Circulating Water	Plant Control and Cable Spreading Structure
Combustible Gas Control	Primary Containment
Condensate & Feedwater	Primary Containment Mechanical
Condensate Storage	Radioactive Waste Building
Control Rod Drive	Radwaste Solid & Liquid
Core Spray	Reactor Building
Cranes, Heavy Loads, Rigging	Reactor Building Closed Cooling Water
Demineralized Water	Reactor Core Isolation Cooling

Diesel Fuel Oil Transfer House	Reactor Head Vent System
Emergency Diesel Generator Building	Reactor Pressure Vessel
Emergency Diesel Generators	Reactor Pressure Vessel Internals
Emergency Filtration Treatment Building	Reactor Recirculation
Emergency Service Water	Reactor Vessel Instrumentation
Fire	Reactor Water Cleanup
Fuel Pool Cooling & Cleanup	Residual Heat Removal
Hangers and Supports	Secondary Containment
Heating & Ventilation	Service & Seal Water
High Pressure Coolant Injection	Standby Liquid Control
HPCI Building	Structures Affecting Safety
Instrument and Service Air	Turbine Building
Intake Structure	Turbine Generator System
Main Condenser	Underground Bus Duct
Main Steam	Wells and Domestic Water
Miscellaneous SBO Yard Structures	

Preventive Actions

Selection of bolting material and use of lubricants are based on design specifications, vendor and industry recommendations, plant and industry experience and include the guidance of EPRI NP-5769, NUREG-1339, and the additional guidance of EPRI TR-104213, EPRI NP-5067 (Good Bolting Practices), and EPRI NP-6316, Guidelines for Threaded-Fastener Application in Nuclear Power Plants. This guidance helps to prevent or mitigate the degradation of bolting within the scope of license renewal.

In accordance with plant procedures on bolting practices, initial bolting of pressure retaining joints includes pre-assembly inspection and cleaning requirements, use of bolting patterns, increased application of torque through multiple passes, and two complete passes at 100% of the desired torque.

Post-bolting inspections include verifying contact between the fastener and flange and proper flange alignment.

Parameters Monitored or Inspected

The Bolting Integrity Program monitors bolting within the scope of license renewal for aging effects due to loss of material (corrosion) and stress corrosion cracking (for high strength bolts and bolts inside the Reactor Pressure Vessel). The program also monitors for loss of preload. Closure bolting for pressure retaining joints is monitored for signs of corrosion and leakage and structural bolting is inspected for signs of corrosion, rust, etc.

High strength bolts (actual yield strength $\geq$150 ksi) subject to aging management review in license renewal are used in one application at Monticello. The 64 reactor pressure vessel head closure studs are comprised of SA540, Grade B23/24, Class 3. These bolts are included in the Reactor Head Closure Studs Program and monitored for stress corrosion cracking. The studs are not metal plated and have had a manganese phosphate coating applied.

As described in the Scope of Program, several MNGP Aging Management Programs are relied upon to perform bolting inspections. As an enhancement to bolting inspection requirements, the guidance for performing visual bolting inspections contained in EPRI TR-104213 and the Good Bolting Practices Handbook (EPRI NP-5067 Volumes 1 and 2) will be added to the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program, Structures Monitoring Program and the System Condition Monitoring Program.

Detection of Aging Effects

Inspection of bolting for ASME Section XI, Class 1, 2, 3, and MC components is performed in accordance with the requirements of American Society of Mechanical Engineers (ASME) Section XI, Tables IWB 2500-1, IWC 2500-1, IWD-2500-1, and IWE-2500-1, respectively except as allowed by code cases, relief requests, or interpretations. Requirements of IWF-2500-1 for Class 1, 2, and 3 structural bolting inspections apply in a similar manner. IW sections for performing inspections are based on the 1995 code edition through the 1996 addenda. The ASME Section XI program uses three types of examination: surface, volumetric, and visual. Surface examinations indicate the presence of surface discontinuities and may be conducted by magnetic particle, liquid penetrant, or an Eddy Current test method. Volumetric examination indicates the presence of discontinuities throughout the volume of material and may be conducted from either the inside or outside of a component. Visual examinations cover a number of observation techniques. VT-1 examinations detect discontinuities and imperfections on the surface of components, including such conditions as cracks, wear, or corrosion. VT-2 examinations detect evidence of leakage from pressure retaining components. VT-3 examinations determine the general mechanical and structural condition of components and their supports by verifying parameters such as clearances, settings, and physical displacements and by detecting discontinuities and imperfections, such as loss of integrity at bolted connections, loose or missing parts, debris, corrosion, wear, or erosion. The only high strength bolts (actual yield strength $\geq$ 150 ksi) used in an ASME Section XI application are the reactor vessel head studs which are inspected to the applicable requirements of IWB-2500-1 and further managed under the Reactor Head Closure Studs Monitoring Program. The 10 CFR 50, Appendix J Program provides an additional inspection method, through established leak rate acceptance criteria, for detecting aging effects.

As ASME Section XI inspections do not address all bolting within the scope of license renewal, a number of other programs are relied upon to perform additional inspections. These additional inspections are visual in nature and include checking both the material condition of bolting for signs of corrosion, wear, etc. and associated pressure retaining joints for signs of leakage.

Upon detection of degraded conditions, follow-up inspections, repairs, replacements, or application of additional testing methods are performed as required by the site Corrective Action Program and applicable acceptance criteria of ASME Section XI. Follow-up actions could include torque checks, bolt removal, ASME Section XI type examinations, or use of other diagnostic techniques.

Monitoring and Trending

The ASME Section XI examination schedule was developed from ASME Code requirements, risk-informed methodology, individual component examination history, and plant scheduling needs such as optimizing insulation removal and scaffolding needs. The examination schedule is submitted to the NRC as part of the In-Service Inspection Examination Plan.

The inspection schedules for the 10 CFR 50, Appendix J Program are based on 10 CFR 50, Appendix J, Option B and the guidance of NRC Regulatory Guide 1.163, Performance-Based Containment Leak-Test Program, dated September

1995. Appendix J, Option B, allows extended test intervals based on satisfactory performance and expectation of continued satisfactory performance through the test interval. Testing intervals can be extended up to every 10 years for the Integrated Leak Rate Test and Type B tests, and every 5 years for Type C tests. Main Steam Isolation Valves, main feedwater isolation check valves, vent and purge valves and the personnel airlock are tested at an interval not to exceed 30 months. Special conditions, such as major modifications or replacements, also require the performance of a leak rate test.

Plant operating experience has demonstrated these ASME Section XI based schedules are supportive of the detection and correction of cracks and leakage.

For plant bolting covered by other inspection programs (e.g., System Condition Monitoring Program), identified leakage is evaluated through the site Corrective Action Program and appropriate actions such as immediate repair, increased monitoring, etc. are implemented based on the significance and impact of the leak. This may include daily checks, such as those performed during operations walk downs, or other actions depending on the significance, trend, and ALARA considerations.

Acceptance Criteria

Bolting within the scope of the ASME Section XI Program for which indications are not removed (through repair or replacement) is evaluated in accordance with IWB-3000, IWC-3000, IWD-3000, and IWE-3000 for Class 1, 2, 3, and MC components, respectively. For Class 1, 2, and 3 component support bolting, acceptance standards of IWF-3410 are implemented which include deformations or structural degradations; missing, detached or loosened items; misalignment or improper clearances; and general corrosion on machined or sliding surfaces.

The 10 CFR 50, Appendix J Program includes acceptance criteria for leakage tests and requirements for visual examinations. Unacceptable leakage requires correction and retest to confirm the condition has been corrected.

Additional programs relied on to visually monitor bolt condition are noted above. Those programs where additional inspection guidance for bolting would enhance the program include the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program, Structures Monitoring Program and the System Condition Monitoring Program. These programs will be enhanced to include the appropriate guidance for performing visual bolting inspections contained in EPRI TR-104213 and the Good Bolting Practices Handbook (EPRI NP-5067 Volumes 1 and 2). This additional guidance will assist in the determination of bolt repair or replacement.

For pressure retaining components, major leaks that adversely impact plant operations or safety would be immediately repaired or isolated as required by the site Corrective Action Program and any additional applicable program requirements (such as ASME Section XI repair and replacement requirements). Identified leaks are evaluated for their impact on continued operation, need for immediate correction, and potential for increased consequence if not immediately addressed.

Corrective Actions

Repair and replacement of bolting is performed in accordance with: (1) corrective actions developed through application of the site Corrective Action Program, (2) IWA-4000, and (3) with plant procedures on bolting practices that include consideration of EPRI NP-5067 Volumes 1 and 2 (Good Bolting Practices), EPRI NP-5769, and EPRI TR-104213. ASME Section XI repairs and replacements are based on the 2001 Edition of Section XI per a previously approved ISI Relief Request.

Refer also to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

Both the industry and NRC have revealed a number of instances of bolting concerns from material control and 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. Therefore, there is reasonable assurance the MNGP Bolting Integrity Program is effective in implementing bolting requirements and managing aging effects.

Conclusion

The Bolting Integrity Program includes requirements for bolt material selection, control, assembly, bolt up patterns, torquing, and use of thread lubricants consistent with EPRI guidance and industry and plant experience. A number of aging management programs are credited by the Bolting Integrity Program to cover the inspections of all bolting within the scope of license renewal at MNGP. Collectively, the credited programs with the noted enhancements constitute the Bolting Integrity Program.

Implementation of the MNGP Bolting Integrity Program will provide reasonable assurance that aging effects will be managed so that the structures, systems, and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.5 Buried Piping & Tanks Inspection

Program Description

The buried piping and tanks inspection program consists of preventive and condition monitoring measures to manage the aging effects for buried piping, conduit and tanks in scope for license renewal. Buried components in scope for license renewal include carbon steel piping, bolting, conduit and tanks (loss of material due to general, crevice, galvanic, MIC and pitting corrosion) and cast iron piping (loss of material due to general, crevice, galvanic, MIC and pitting corrosion and selective leaching). Preventive measures consist of protective coatings and/or wraps on buried components. Condition monitoring consists of periodic inspections of buried components.

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

NUREG-1801 Consistency

The MNGP Buried Piping and Tanks Inspection Program is an existing program. It will be enhanced to be consistent with the recommendations of NUREG-1801 Chapter XI, Program XI.M34.

Exceptions to NUREG-1801

None.

Enhancements

The following enhancement(s) are required to satisfy the NUREG-1801 aging management program recommendations. Details of the enhancements are included in the appropriate element descriptions below. Enhancements will be completed prior to the period of extended operation.

- Scope of Program

  The Buried Piping and Tanks Inspection Program will be updated implementing procedures to include inspections of buried components when they are uncovered.

- Parameters Monitored or Inspected

  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.

- Detection of Aging Effects

  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.

- Monitoring and Trending

  The Buried Piping and Tanks Inspection Program will be revised to include a review of previous buried piping issues to determine possible susceptible locations.

Aging Management Program Elements

The elements, which are part of the Buried Piping & Tanks Inspection Program are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M34, “Buried Piping & Tanks Inspection,” are also provided.

Scope of Program

The Buried Piping and Tanks Inspection Program provides for managing loss of material for all buried carbon steel and cast iron components in scope for license renewal. Buried components are coated or wrapped as appropriate to help prevent loss of material caused by corrosion. Buried components in scope for license renewal include piping, bolting, conduit and tanks.

A representative sample of buried underground pipes are periodically uncovered and inspected. Program implementing procedures will be enhanced to include periodic inspections of components when they are uncovered.

Since buried components are not routinely uncovered, internal tank inspections and several systems monitoring and functional testing activities are relied upon to provide an early warning of leaking such that repairs can be made and loss of component intended function is prevented.

The Buried Piping and Tanks Inspection Buried Services Monitoring Program manages the aging effects for components in the following systems and structures:

Emergency Diesel Generators	Hangers and Supports
Emergency Service Water	Secondary Containment
Fire	

Preventive Actions

Buried components in scope for License Renewal are coated or wrapped as appropriate to help prevent loss of material caused by corrosion. Coatings on buried piping and tanks perform a preventive function by providing a protective barrier between the component and the mild soil/groundwater.

Parameters Monitored or Inspected

A visual inspection of the pipe coating is periodically performed on a representative sample of buried underground pipes.

Periodic inspections of buried components when they are uncovered will be performed. However, most 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 components. These activities include:

- Periodic pressure testing of buried Emergency Service Water piping.
- Periodic flow and pressure testing of buried Fire Main piping.
- Periodic inspection of the inside of the Diesel Fuel Oil Storage Tank.
- Periodic inspection of vapor monitoring points and water wells.
- Daily inspection of Underground Storage Tank Liquid Level.

These activities are neither preventive nor mitigative in nature. The system monitoring and functional testing activities actually 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. An enhancement to the internal inspection of the Diesel Fuel Oil Storage Tank activity will be to formalize the activity as a scheduled procedure.

Detection of Aging Effects

Based on samples taken from domestic water and monitoring wells, the soil conditions around the plant are very mild. In addition, plant operating experience indicates that there is not one area more susceptible to corrosion than any other. An enhancement to the underground piping inspections is 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 further evaluation may include hardness testing if the aging mechanism is indeterminate. In addition, an enhancement to the buried piping inspection will be to specify the procedure frequency as 10 years.

Also, an internal visual and ultrasonic wall thickness inspection of the Diesel Fuel Oil Storage Tank T-44 is performed. An enhancement to this inspection is to specify the inspection frequency as 10 years.

Inspections of buried components, when they are uncovered, are performed. However, most buried components are not routinely, if ever, uncovered during maintenance activities. Therefore, other system monitoring and functional testing activities are relied upon to provide effective degradation aging management of buried components. These activities are described in Parameters Monitored or Inspected.

The activities described in this section provide reasonable assurance that aging effects of buried pipes and tanks will be detected prior to loss of intended function.

Monitoring and Trending

Previous plant inspection and testing activities have not identified any susceptible locations. In addition, the soil at MNGP is very mild. Therefore, the Buried Piping and Tanks Inspection Program activities use a combination of representative inspections and tests to detect aging degradation. These inspection and test results are documented as part of the program or procedural processes and sent to the appropriate personnel for trending and analysis. The pipe inspection procedure will be enhanced to include a review of previous buried piping issues to determine possible susceptible locations.

Acceptance Criteria

Coating and wrapping degradation is reported, evaluated and entered into the corrective action process whenever buried components are uncovered during excavation activities. In addition, evidence of metal surface corrosion and any minor leakage detected through periodic testing and visual inspections are entered into the corrective action process and evaluated to confirm the system and components ability to perform their intended functions.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

The MNGP Buried Piping and Tanks Inspection Program relies on preventive measures, periodic inspections and functional testing to manage the aging effects of buried components. MNGP operating experience has shown no buried component failures for in scope systems (ESW, DGN, HGR, SCT, FIR). This indicates that the protective coating and wraps have provided excellent protection for the buried components. The only failures of buried components were on the well water piping system and the instrument air system to the cooling towers. These systems are not safety related and not in scope for LR. The locations of the failures are not near any buried components in scope for LR. The well water piping failure was postulated to be due to MIC and not a failure of the protective coating. The cause of the failure of the instrument air line is yet to be determined.

Periodic visual and UT inspections of buried pipe have shown no significant loss of material due to pipe corrosion. Periodic UT inspections of the Diesel Fuel Oil Storage Tank interior 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.

Conclusion

Implementation of the MNGP Buried Piping and Tanks Inspection Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.6 Bus Duct Inspection Program

Program Description

The Bus Duct Inspection Program will be a new program consisting of the appropriate ten elements described in Appendix A of NUREG-1800, Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants.The purpose of this aging management program will be to demonstrate, for in-scope non-segregated bus ducts, 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 so that there is reasonable assurance that the non-segregated bus ducts will perform their intended function in accordance with the current licensing basis during the period of extended operation. The intended function of non-segregated bus ducts is to provide electrical connections to specified sections of an electrical circuit to deliver voltage, current or signals.

Industry operating experience indicates that the failure of bus ducts is caused by the cracking of bus bar insulation (bus sleeving) combined with the accumulation of moisture or debris. Cracked insulation in the presence of moisture or debris provides phase-to-phase or phase-to-ground electrical tracking paths, which can result in catastrophic failure of the buses.

Bus ducts exposed to appreciable ohmic heating during operation may experience loosening of bolted connections because of the repeated cycling of connected loads. This phenomenon can occur in heavily loaded circuits, i.e., those exposed to appreciable ohmic heating. Sandia 96-0344 identified instances of bolted connection loosening at several plants due to thermal cycling. NRC Information Notice 2000-14 identified torque relaxation of splice plate connecting bolts as one potential cause of a bus duct fault.

The primary objective of the aging management program is to provide an inspection of bus ducts. 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.

The purpose of the aging management program is to provide reasonable assurance that the intended functions of nonsegregated bus ducts that are not subject to the environmental qualification requirements of 10 CFR 50.49 and are exposed to adverse localized environments caused by the ingress of moisture, 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 maintained consistent with the current licensing basis through the period of extended operation. This program considers the technical information provided in Information Notice No. 89-64.

NUREG-1801 Consistency

The Bus Duct Inspection Program is a plant specific program. The program will be consistent with the applicable ten elements described in Appendix A of NUREG-1800.

Exceptions to NUREG-1801

Not Applicable.

Enhancements

Not Applicable.

Aging Management Program Elements

The new Bus Duct Inspection Program will consists of the appropriate ten elements described in Appendix A of NUREG-1800, Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants. Each element is described below.

Scope of Program

This program applies to all bus ducts within the scope of license renewal.

The program manages the aging effects for components in the following commodity group:

Off Site Power / SBO Recovery Path

Preventive Actions

This is an inspection program and no actions are taken as part of this program to prevent or mitigate aging degradation.

Parameters Monitored or Inspected

A sample of accessible bolted connections (bus joints and ending devices) will be checked for proper torque, or the resistance of bolted joints will be checked using a micro-ohm meter of sufficient current capacity that is suitable for checking bus bar connections. This program will also inspect the internal portions of accessible bus ducts for cracks, corrosion, foreign debris, dust buildup, and moisture intrusion. The bus insulating system will be inspected for signs of embrittlement, cracking, melting, swelling, or discoloration, which may indicate overheating or aging degradation. The bus supports will be inspected for structural integrity and cracking.

Detection of Aging Effects

Visual inspection of internal portions of bus ducts detects cracks, corrosion, debris, dust and moisture. Visual inspection of the bus insulating system detects embrittlement, cracking, melting, swelling and discoloration. Visual inspection of bus supports detects cracking and lack of structural integrity. Internal portions of bus ducts, the bus insulating system, and the bus supports are visually inspected at least once every 10 years.

A torque test or a resistance test of a sample of accessible bolted connections is performed at least once every 10 years. This program will be completed before the end of the initial 40-year license term and every 10 years thereafter. This is an adequate period to preclude failures of the bus ducts since experience has shown that aging degradation is a slow process. A 10-year inspection frequency will provide two data points during a 20-year period, which can be used to characterize the degradation rate.

Existing plant preventive maintenance procedures require the bus duct located outside of the Turbine Building (between the Turbine Building wall and the 2R transformer and between the Turbine Building wall and the 1R transformer) to be inspected. These inspections require the removal of all outside bus support damage and loose connections. The inspections have a QC witness point to ensure Quality Assurance. These procedures require a micro-ohm test and a power factor test once maintenance activities have been completed.

These preventive maintenance procedures will be revised to include license renewal requirements.

Monitoring and Trending

Trending actions are not included as part of this program because the ability to trend inspection results is limited.

Acceptance Criteria

Bolted connections must meet the manufacturer’s minimum torque specifications, or the resistance of bolted joints must meet required specifications. Bus ducts are to be free from any surface anomalies that suggest that conductor insulation degradation exists. An additional acceptance criterion includes no indication of unacceptable corrosion, cracking, foreign debris, dust buildup, or moisture intrusion. Any condition or situation that, if not corrected, could lead to a loss of intended function is considered unacceptable.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

This 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.

Conclusion

Implementation of the MNGP Bus Duct Inspection Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation. The program will be implemented prior to the period of extended operation.

B2.1.7 BWR Control Rod Drive Return Line Nozzle

Program Description

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.

NUREG-1801 Consistency

The BWR Control Rod Drive Return Line Nozzle Program is an existing program. With exceptions, it is consistent with the recommendations of NUREG-1801, Chapter XI, Program XI.M6, “BWR Control Rod Drive Return Line Nozzle.”

Exceptions to NUREG-1801

This subsection identifies the elements of the MNGP AMP that are not consistent with the corresponding NUREG-1801 AMP elements.

For further details, see the following element discussion(s) on the exceptions to NUREG-1801 aging management program elements:

- Parameters Monitored/Inspected

  The NUREG-0619 augmented inspections are not performed. This is due to the CRDRL nozzle being capped and the NUREG-0619 augmented examination no longer being required.

- Detection of Aging Effects

  The NUREG-0619 augmented inspections are not performed. This is due to the CRDRL nozzle being capped and the NUREG-0619 augmented examination no longer being required.

- Monitoring and Trending

  The NUREG-0619 augmented inspections are not performed. This is due to the CRDRL nozzle being capped and the NUREG-0619 augmented examination no longer being required.

Enhancements

None.

Aging Management Program Elements

The elements, which are used in the BWR Control Rod Drive Return Line Nozzle Program, are described below. The results of an evaluation of each element against NUREG-1801, Section XI Program XI.M6 are also provided.

Scope of Program

The scope of the MNGP BWR Control Rod Drive Return Line Nozzle Program is part of the MNGP ASME Section XI In-Service Inspection Program and provides for condition monitoring of the BWR CRDRL nozzle in accordance with ASME Section XI, Table IWB-2500-1, Examination Category B-D.

MNGP cut and capped its CRDRL nozzle in 1977. This modification (and the attendant operational changes) has mitigated the aging effects such that no augmented inspections are required.

The BWR Control Rod Drive Return Line Nozzle Program consists of MNGP activities that manage the aging effects for the components in the following systems and structures:

Reactor Pressure Vessel

Preventive Actions

The MNGP BWR Control Rod Drive Return Line Nozzle Program is a condition monitoring program that detects degradation of components before loss of intended function. Mitigation is accomplished by confirmation of proper return flow capability, two-pump operation and cutting and capping the CRDRL nozzle without rerouting.

Parameters Monitored or Inspected

The aging effect that is monitored/inspected with the MNGP BWR Control Rod Drive Return Line Nozzle Program is crack initiation and growth. The BWR Control Rod Drive Return Line Nozzle Program is a condition monitoring program that detects and sizes flaws and defects by implementing the examination and inspection requirements of ASME Section XI, Table IWB-2500-1.

As a result of capping the CRDRL nozzle as previously discussed, the NUREG-0619 augmented examinations are no longer required. This is considered a program element exception.

Detection of Aging Effects

The detection of aging effects is prescribed by the MNGP BWR Control Rod Drive Return Line Nozzle Program in accordance with the requirements of ASME Section XI to ensure that aging effects will be discovered and repaired before the loss of intended function. The nondestructive detection technique used is the ultrasonic (UT) volumetric examination method to detect discontinuities, flaws, and defects within the BWR CRDRL nozzle. The extent, schedule, technique, and personnel qualifications for the examinations are rigorously identified within the program.

As a result of capping the CRDRL nozzle the NUREG-0619 augmented examinations are no longer required. This is considered a program element exception.

Monitoring and Trending

The MNGP BWR Control Rod Drive Return Line Nozzle Program prescribes the monitoring and trending of the BWR CRDRL nozzle examination activities. The program requirements for inspection schedule, extent, frequency, sequence of examinations, re-examinations, and additional examinations are in accordance with ASME Section XI, Article IWB-2000.

As a result of capping the CRDRL nozzle the NUREG-0619 augmented examinations are no longer required. This is considered a program element exception.

Acceptance Criteria

The MNGP BWR Control Rod Drive Return Line Nozzle Program prescribes the acceptance criteria for the BWR CRDRL nozzle examinations.

The program requirements for acceptance, rejection, and analytical evaluations of indications and relevant conditions are in accordance with ASME Section XI, Article IWB-3000 and MNGP procedures for Class 1 components. When indications exceed acceptance standards, corrective actions are initiated in accordance with MNGP procedures.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

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 BWR Control Rod Drive Return Line Nozzle Program, as part of the MNGP ASME Section XI In-Service Inspection Program has detected aging degradation and implemented appropriate corrective actions. The program has demonstrated on several occasions that it provides reasonable assurance that aging effects are being managed for the BWR CRDRL nozzle. This is based on a review of past NRC inspection reports, INPO evaluations, audits, and self-assessments that noted program effectiveness and implementation of corrective actions to improve performance. These reports were generated for Cycle 21 and during Refueling Outage 21. The results of the ISI activities indicate that the integrity of the plant systems has been maintained.

Conclusion

Implementation of the MNGP BWR Control Rod Drive Return Line Nozzle Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.8 BWR Feedwater Nozzle

Program Description

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.

NUREG-1801 Consistency

The BWR Feedwater Nozzle Program is an existing program. It will be enhanced to be consistent with the recommendations of NUREG-1801, Chapter XI, Program XI.M5, “BWR Feedwater Nozzle.”

Exceptions to NUREG-1801

None.

Enhancements

The following enhancement(s) are required to satisfy the NUREG-1801 aging management program recommendations. Details of the enhancements are included in the appropriate element descriptions below. Enhancements are scheduled for implementation prior to the period of extended operation.

- Parameters Monitored/Inspected

  The BWR Feedwater Nozzle Program will be enhanced so that the parameters monitored and inspected are consistent with the recommendations of GE NE-523-A71-0594-A, Revision 1.

- Detection of Aging Effects

  The BWR Feedwater Nozzle Program will be enhanced so 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.

- Monitoring and Trending

  The BWR Feedwater Nozzle Program will be enhanced so that inspections will be scheduled per recommendations of GE NE-523-A71-0594-A, Revision 1.

Aging Management Program Elements

The program elements, which are part of the MNGP BWR Feedwater Nozzle Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI Program XI.M5, “BWR Feedwater Nozzle,” are also provided.

Scope of Program

The scope of the MNGP BWR Feedwater Nozzle Program is part of the MNGP Section XI In-Service Inspection Program and provides for condition monitoring of the BWR feedwater nozzles for crack initiation and growth in accordance with ASME Section XI, Table IWB-2500-1, Examination Category B-D.

The BWR Feedwater Nozzle Program manages the aging effects for components of the following systems and structures:

Reactor Pressure Vessel

Preventive Actions

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.

Parameters Monitored or Inspected

The aging effect parameter that is monitored/inspected with the MNGP BWR Feedwater Nozzle Program is crack initiation and growth. The BWR Feedwater Nozzle Program is a condition monitoring program that detects and sizes flaws and defects by implementing the examination and inspection requirements of ASME Section XI with Appendix VIII. This element will be enhanced so that it is consistent with the recommendations of GE NE-523-A71-0594-A, Revision 1.

Detection of Aging Effects

The detection of aging effects is prescribed by the MNGP BWR Feedwater Nozzle Program in accordance with the requirements of ASME Section XI with Appendix VIII to ensure that aging effects will be discovered and repaired before the loss of intended function. The nondestructive detection technique used is the ultrasonic (UT) volumetric examination method to detect discontinuities, flaws, and defects within the BWR feedwater nozzles. This element will be enhanced so 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.

Monitoring and Trending

The MNGP BWR Feedwater Nozzle Program prescribes the monitoring and trending of the BWR feedwater nozzles. The program requirements for inspection schedule, extent, frequency, sequence of examinations, re-examinations, and additional examinations are in accordance with ASME Section XI, Article IWB-2000.

This element will be enhanced so that inspections will be scheduled per recommendations of GE NE-523-A71-0594-A, Revision 1.

The inspections to be performed at each refuel outage are determined by review of ASME Section XI, as well as past ISI experience, and the MNGP ASME Section XI ISI Program, "In-Service Inspection Plan, Fourth Interval May 1, 2003 through May 31, 2012," Revision 2.

Acceptance Criteria

The MNGP BWR Feedwater Nozzle Program prescribes the acceptance criteria for the BWR feedwater nozzles. The program requirements for acceptance, rejection, and analytical evaluation are in accordance with ASME Section XI, Article IWB-3000.

Indications and relevant conditions detected during examinations are evaluated in accordance with ASME Section XI, Article IWB-3000, for Class 1 in accordance with MNGP procedure.

When a flaw exceeds the applicable acceptance standards of IWB-3500, corrective action is initiated in accordance with applicable procedures. An evaluation is performed in accordance with MNGP procedures.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

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

- Repairs were made to the feedwater nozzles and safe ends in 1977 to minimize damage to the feedwater nozzles due to thermal cycling. Cladding was removed from the nozzle blend radius and bore, and a feedwater sparger interference fit thermal sleeve with a piston ring seal was installed.
- New feedwater nozzle safe ends were installed in 1981. These safe ends have a tuning fork design with a welded-in thermal sleeve and provide a significant reduction in thermal cycling.
- NUREG-0619, along with NRC Generic Letter 81-11 considerations, was incorporated into the BWR Feedwater Nozzle Program during the third 10-Year inspection interval ending on May 1, 2003. No cracking was identified as a result of these inspections.

The BWR Feedwater Nozzle Program has detected aging degradation and implemented appropriate corrective actions. The program has demonstrated on several occasions that it provides reasonable assurance that aging effects are being managed for the BWR feedwater nozzles. This is based on a review of past NRC inspection reports, INPO evaluations, audits, and self-assessments that noted program effectiveness and implementation of corrective actions to improve performance.

Conclusion

The MNGP BWR Feedwater Nozzle Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.9 BWR Penetrations

Program Description

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 (with approved ISI Relief Requests) 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 (Reference 5). BWRVIP-130 supersedes previous revisions of the guidelines, including BWRVIP-29 (TR-103515), BWR Water Chemistry Guidelines - 1993 Revision.

Monticello'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.

NUREG-1801 Consistency

The BWR Penetrations Program is an existing program. With exceptions it is consistent with the recommendations of NUREG-1801, Chapter XI, Program XI.M8, “BWR Penetrations.”

Exceptions to NUREG-1801

This subsection identifies the elements of the MNGP AMP that are not consistent with the corresponding NUREG-1801 AMP elements.

For further details, see the following element discussion(s) on the exceptions to NUREG-1801 aging management program elements:

- Program Description and Preventive Actions

  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.

Enhancements

None.

Aging Management Program Elements

The program elements, which are part of the MNGP BWR Penetrations Aging Management Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M8, “BWR Penetrations” is also provided.

Scope of Program

The scope of the MNGP BWR Penetrations Program is part of the MNGP ASME Section XI In-Service Inspection Program and provides for condition monitoring of the material susceptible to the aging effect of crack initiation and growth in accordance with the applicable ASME Section XI requirements and Tables IWB-2500-1. The guidelines in BWRVIP-49 and BWRVIP-27 were incorporated into the BWR Penetrations Program.

Repair design criteria for instrumentation penetrations and for the SLC line is in accordance with ASME Section XI which is equivalent to BWRVIP-57 and BWRVIP-53 respectively per NUREG-1801, Chapter XI, Program XI.M8, Element 7.

The MNGP program mitigates the aging effect of crack initiation and growth through the water chemistry programs. These programs are maintained consistent with the guidelines of EPRI BWRVIP-130 (TR-1008192).

The BWR Penetrations Program manages the aging effects for components of the following systems and structures:

Reactor Pressure Vessel

Preventive Actions

The MNGP BWR Penetrations Program is a condition monitoring program that detects degradation of components before the loss of intended function.

The MNGP Plant Chemistry Program uses BWRVIP-130 (EPRI TR-1008192), BWR Water Chemistry Guidelines - 2004 Revision. NUREG-1801 references BWRVIP-29 (EPRI TR-103515), BWR Water Chemistry Guidelines - 1993 Revision.

In the "Safety Evaluation Report Related to the License Renewal of Peach Bottom Atomic Power Station, Units 2 and 3" (NUREG-1769, Accession Number ML030300673), the NRC found the provisions of BWRVIP-79 (TR-103515-R2), BWR Water Chemistry Guidelines - 2000 Revision, acceptable because the program is based on updated industry experience. BWRVIP-130 (TR-1008192) is the current update of the BWR Water Chemistry Guidelines and supersedes BWRVIP-79 (TR-103515-R2). BWRVIP-130 is based on updated industry experience, with increased emphasis on fuel performance concerns, while retaining chemistry parameters, action levels and associated measurement frequencies essentially unchanged.

Parameters Monitored or Inspected

The aging effect parameter that is monitored/inspected with the MNGP BWR Penetrations Program is crack initiation and growth. The BWR Penetrations Program is a condition-monitoring program.

The program monitors the effects of SCC/IGSCC and cyclic loading on the intended function of the component by detection and sizing of cracks by ISI in accordance with the guidelines of approved BWRVIP-49 or BWRVIP-27 and the requirements of ASME Code, Section XI, Table IWB 2500-1 (1995 edition through the 1996 addenda).

In addition, the Hydrogen Water Chemistry System was placed in operation in 1988 in accordance with the recommendations of the BWR Owners Group.

Detection of Aging Effects

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-P and NRC approved alternatives for Categories B-F and B-J (Risk-Informed ISI (RI-ISI)). The material susceptible to the aging effect of crack initiation and growth is within the scope of the MNGP BWR Penetrations Program and is being periodically examined using the ultrasonic (UT) volumetric, surface, and visual nondestructive examination methods as applicable.

The guidelines in BWRVIP-49 and BWRVIP-27 have been incorporated into the BWR Penetrations Program. The guidelines in BWRVIP-03 are also being followed. The nondestructive detection techniques used are the ultrasonic (UT) volumetric, surface, and visual examination methods to detect discontinuities, flaws, and defects within the material susceptible to crack initiation and growth. The extent, schedule, technique, and personnel qualifications for the examinations are rigorously identified within the program.

Further details for examination are described in the MNGP Aging Management Program, "ASME Section XI, In-Service Inspection, Subsections IWB, IWC, and IWD."

Monitoring and Trending

The MNGP BWR Penetrations Program prescribes the monitoring and trending of the material susceptible to crack initiation and growth. The requirements of ASME Section XI including the schedule requirements of IWB-2400 have been incorporated into the MNGP BWR Penetrations Program. If defects are detected, the scope of examination is expanded per the requirements of IWB-2430.

The program requirements for inspection schedule, extent, frequency, sequence of examinations, re-examinations, and additional examinations are in accordance with ASME Section XI, Article IWB-2000, and/or the NRC approved alternatives.

The guidelines in BWRVIP-48 and the guidelines in BWRVIP-27 were incorporated into the BWR Penetrations Program.

Acceptance Criteria

The acceptance criteria for the material susceptible to crack initiation and growth are prescribed by the MNGP BWR Penetrations Program. The program requirements for acceptance, rejection, and analytical evaluation are in accordance with ASME Section XI, Article IWB-3000.

The guidelines in BWRVIP-49 and BWRVIP-27 were incorporated into the BWR Penetrations Program. Evaluation of crack growth is in accordance with Article IWB-3000 of ASME Section XI with guidance from BWRVIP-14, BWRVIP-59, and BWRVIP-60.

Corrective Actions

Flaw identification and evaluation is accomplished in accordance with ASME Section XI as augmented by BWRVIP-27 and BWRVIP-49. Identified flaws are repaired or replaced, based on the evaluation, in accordance with ASME Section XI repair and replacement criteria that is equivalent to BWRVIP-57and BWRVIP-53. The guidelines of BWRVIP-48 are also followed as they apply.

Also refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

The BWR Penetrations Program has been effective in managing aging effects of materials susceptible to crack initiation and growth. Materials within the scope of the 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:

- The Standby Liquid Control nozzle safe end was replaced in 1984 using different materials to resist IGSCC.
- 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.
- 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.

Results of prior NRC inspections, INPO evaluations, audits, and self-assessments indicate an effective program has been established. This is demonstrated by the actions taken to date to address and replace where needed age susceptible materials.

Conclusion

Implementation of the MNGP BWR Penetrations Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.10 BWR Stress Corrosion Cracking

Program Description

The Monticello Nuclear Generating Plant BWR Stress Corrosion Cracking Program is an existing program and is part of the MNGP ASME Section XI In-Service Inspection Program. 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.

NUREG-1801 Consistency

The BWR Stress Corrosion Cracking Program is an existing program. With exceptions, it is consistent with the recommendations of NUREG-1801, Chapter XI, Program XI.M7, “BWR Stress Corrosion Cracking.”

Exceptions to NUREG-1801

This subsection identifies the elements of the MNGP AMP that are not consistent with the corresponding NUREG-1801 AMP elements.

For further details, see the following element discussion(s) on the exceptions to NUREG-1801 aging management program elements:

- Preventive Actions

  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.

Enhancements

None.

Aging Management Program Elements

The program elements, which are part of the MNGP BWR Stress Corrosion Cracking Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI Program XI.M7, “BWR Stress Corrosion Cracking,” are also provided.

Scope of Program

The MNGP BWR Stress Corrosion Cracking Program is part of the NRC reviewed MNGP ASME Section XI In-Service Inspection Program and provides for condition monitoring of the material susceptible to BWR stress corrosion cracking in accordance with the applicable requirements of ASME Section XI. NUREG-0313 and NRC GL-88-01 guidance are part of the BWR Stress Corrosion Cracking Program.

Reactor coolant water chemistry is monitored and maintained in accordance with the guidelines in EPRI BWRVIP 130 (TR-10008192) to maintain high water purity to reduce susceptibility to SCC, intergranular attack (IGA), or IGSCC. The program description and evaluation and technical basis of monitoring and maintaining reactor water chemistry are presented in the MNGP Plant Chemistry Program.

The BWR Stress Corrosion Cracking Program manages the aging effects for components of the following systems and structures:

Control Rod Drive	Reactor Pressure Vessel
Core Spray	Reactor Recirculation
High Pressure Coolant Injection	Residual Heat Removal

Preventive Actions

The MNGP BWR Stress Corrosion Cracking Program Includes the elements delineated in NUREG-0313 and NRC GL 88-01 regarding selection of materials that are resistant to sensitization, use of special processes that reduce residual tensile stresses, and monitoring and maintenance of reactor coolant chemistry.

Replacement stainless steel components at Monticello are provided in the solution annealed condition, with carbon less than 0.035%, and ferrite levels greater than 7.5%. In addition, existing components are treated with induction heating. Alloy 82 is used for nickel-based alloy filler material.

Reactor coolant water chemistry is monitored and maintained in accordance with the guidelines in 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), BWR Water Chemistry Guidelines - 1993 Revision. The program description, evaluation, and technical basis for monitoring and maintaining reactor water chemistry are presented in the MNGP Plant Chemistry Program.

BWRVIP-29 (TR-103515), BWR Water Chemistry Guidelines - 1993 Revision, is referenced in NUREG-1801, Chapter XI, Program XI.M7.

In the "Safety Evaluation Report Related to the License Renewal of Peach Bottom Atomic Power Station, Units 2 and 3" (NUREG-1769, Accession Number ML030300673), the NRC found the provisions of BWRVIP-79 (TR-103515-R2), BWR Water Chemistry Guidelines - 2000 Revision, acceptable because the program is based on updated industry experience. BWRVIP-130 (TR-1008192) is the current update of the BWR Water Chemistry Guidelines and supersedes BWRVIP-79 (TR-103515-R2). BWRVIP-130 is based on updated industry experience, with increased emphasis on fuel performance concerns, while retaining chemistry parameters, action levels and associated measurement frequencies essentially unchanged.

Parameters Monitored or Inspected

The MNGP BWR Stress Corrosion Cracking Program is a condition monitoring program that monitors for crack initiation and growth by detecting and sizing flaws and defects through implementing the examination and inspection requirements of ASME Section XI. The program detects and sizes cracks and detects leakage by using the examination and inspection guidelines delineated in ASME Section XI, NUREG 0313, Rev. 2, and NRC GL 88-01 as applicable. Examination requirements for IGSCC are conducted in accordance with MNGP's ISI plan.

Detection of Aging Effects

The detection of aging effects is prescribed by the MNGP BWR Stress Corrosion Cracking Program in accordance with the requirements of ASME Section XI, NRC GL 88-01, and RI-ISI to ensure that aging effects will be discovered and repaired before the loss of intended function. The nondestructive detection techniques used are the ultrasonic (UT) volumetric, surface, and visual examination methods to detect discontinuities, flaws, and defects within the material susceptible to BWR stress corrosion cracking. The extent, schedule, technique, and personnel qualifications for the examinations are rigorously identified within the program.

Monitoring and Trending

The MNGP BWR Stress Corrosion Cracking Program prescribes the monitoring and trending of the material susceptible to BWR stress corrosion cracking. The program requirements for inspection schedule, extent, frequency, sequence of examinations, re-examinations, and additional examinations are in accordance with ASME Section XI, Article IWB-2000 and IWC-2000, and the RI-ISI Program with the incorporation of NRC GL-88-01.

Guidelines for resolution of reportable indications, additional examinations, and successive examinations are conducted in accordance with MNGP procedures that are based on ASME Section XI criteria.

Acceptance Criteria

The MNGP BWR Stress Corrosion Cracking Program prescribes the acceptance criteria for the material susceptible to BWR stress corrosion cracking. The program requirements for acceptance, rejection, and evaluation are in accordance with ASME Section XI, Articles IWB-3000 and IWC-3000, and the guidance of applicable and approved BWRVIP documents. There has not been a need to use EPRI guidelines BWRVIP-14, BWRVIP-59, BWRVIP-60, BWRVIP-61, and BWRVIP-62 for evaluating BWR stress corrosion cracking. However, these BWRVIP guidelines are used if necessary.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

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 adequate corrective actions were taken to prevent recurrence. The BWR Stress Corrosion Cracking Program effectively detects flaw indications in susceptible components and contains appropriate guidance for evaluation or repair of flaws. As needed, the inspection plan can be adjusted based on results to enhance program effectiveness.

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 BWR Stress Corrosion Cracking Program aging management activities have detected aging degradation and implemented appropriate corrective actions to maintain system and component intended functions including prompt repair of degraded components prior to failure.

The program has been effective in managing aging effects due to stress corrosion cracking and implementing corrective actions (such as installation of materials less susceptible to BWR stress corrosion cracking). This is based on a review of past NRC inspection reports, INPO evaluations, audits, and self-assessments that noted program effectiveness and implementation of corrective actions to improve performance.

Conclusion

Implementation of the MNGP BWR Stress Corrosion Cracking Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.11 BWR Vessel ID Attachment Welds

Program Description

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.

NUREG-1801 Consistency

The BWR Vessel ID Attachment Welds Program is an existing program. With exceptions, it is consistent with the recommendations of NUREG-1801, Chapter XI, Program XI.M4, “BWR Vessel ID Attachment Welds.”

Exceptions to NUREG-1801

This subsection identifies the elements of the MNGP AMP that are not consistent with the corresponding NUREG-1801 AMP elements.

For further details, see the following element discussion(s) on the exceptions to NUREG-1801 aging management program elements:

- Preventive Actions

  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.

Enhancements

None.

Aging Management Program Elements

The program elements, which are part of the MNGP BWR Vessel ID Attachment Welds Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M4, BWR Vessel ID Attachment Welds, are also provided.

Scope of Program

The scope of the MNGP BWR Vessel ID Attachment Welds Program is part of the MNGP ASME Section XI In-Service Inspection Program and provides for condition monitoring of the reactor vessel interior attachment welds within and beyond the beltline region in accordance with ASME Section XI, Table IWB-2500-1, Examination Category B-N-2. MNGP's in vessel examination procedures monitor the effects of cracking. These procedures are consistent with the recommendations of the BWRVIP-48.

The BWR Vessel ID Attachment Welds Program manages the aging effects for components of the following systems and structures:

Reactor Pressure Vessel

Preventive Actions

The MNGP BWR Vessel ID Attachment Welds Program is a condition monitoring program that detects degradation of components before the loss of intended function. The program follows the guidelines of BWRVIP-48.

Reactor coolant water chemistry is monitored and maintained in accordance with the guidelines in 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) BWR Water Chemistry Guidelines - 1993 Revision. The program description, evaluation, and technical basis of monitoring and maintaining reactor water chemistry are presented in the MNGP Plant Chemistry Program.

BWRVIP-29 (TR-103515), BWR Water Chemistry Guidelines - 1993 Revision is referenced in NUREG-1801, Chapter XI, Program XI.M04.

In the "Safety Evaluation Report Related to the License Renewal of Peach Bottom Atomic Power Station, Units 2 and 3" (NUREG-1769, Accession Number ML030300673), the NRC found the provisions of BWRVIP-79 (TR-103515-R2), BWR Water Chemistry Guidelines - 2000 Revision, acceptable because the program is based on updated industry experience. BWRVIP-130 (TR-1008192) is the current update of the BWR Water Chemistry Guidelines and supersedes BWRVIP-79 (TR-103515-R2). BWRVIP-130 is based on updated industry experience, with increased emphasis on fuel performance concerns, while retaining chemistry parameters, action levels and associated measurement frequencies essentially unchanged.

Parameters Monitored or Inspected

The aging effect parameter that is monitored/inspected with the MNGP BWR Vessel ID Attachment Welds Program is crack initiation and growth. The Vessel ID Attachment Welds Program is a condition monitoring program that detects and sizes flaws and defects by implementing the examination and inspection requirements of ASME Section XI Table IWB-2500-1, "Examination Category B-N-2," with guidance from BWRVIP documents.

No relief has been requested for vessel internal components with hydrogen water chemistry per the guidelines of BWRVIP-62, Technical Basis for Inspection Relief for Components with Hydrogen Injection (EPRI TR-108705).

Detection of Aging Effects

The detection of aging effects is prescribed by the MNGP BWR Vessel ID Attachment Weld Program in accordance with the requirements of ASME Section XI to ensure that aging effects will be discovered and repaired before the loss of intended function. The requirements of ASME Section XI Examination Category B-N-2 including the BWRVIP-03 and BWRVIP-48 guidelines for the reactor vessel interior attachments have been incorporated into the MNGP BWR Vessel ID Attachment Weld Program. The nondestructive detection techniques used include VT-1, VT-3, and enhanced VT-1 (EVT) visual examination methods to determine the general mechanical and structural condition of the reactor vessel interior attachments. The extent and schedule of the examinations are rigorously identified within the program.

Monitoring and Trending

The MNGP BWR Vessel ID Attachment Welds Program prescribes the monitoring and trending of age degradation of the reactor vessel interior attachments. The program requirements for inspection schedule, extent, frequency, sequence of examinations, re-examinations, and additional examinations are in accordance with ASME Section XI, Article IWB-2000.

The requirements of ASME Section XI, including the schedule requirements of IWB-2400 and the BWRVIP-48 guidelines, have been incorporated into the MNGP BWR Vessel ID Attachment Welds Program. If defects are detected, the scope of examination is expanded per the requirements of IWB-2430.

Acceptance Criteria

The MNGP BWR Vessel ID Attachment Welds Program prescribes the acceptance criteria for the reactor vessel interior attachments. The program requirements for acceptance, rejection, and analytical evaluation are in accordance with ASME Section XI, Article IWB-3000. When a flaw exceeds the applicable acceptance standards of IWB-3500 or BWRVIP-48, corrective action is initiated in accordance with applicable MNGP procedures. An Analytical Evaluation may be performed in accordance with IWB-3600. There has not been a need to use EPRI guidelines BWRVIP-14, BWRVIP-59, and BWRVIP-60 for evaluating BWR vessel ID attachment welds, However, these BWRVIP guidelines are used if necessary.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

The inspection and testing methodologies of the BWR Vessel ID Attachment Welds Program have been effective in detecting aging due to cracking. 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% 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 Reactor Vessel ID Attachment Welds Program has detected aging effects and implemented appropriate corrective actions. The program has demonstrated on several occasions that it provides reasonable assurance that aging effects are being managed for reactor vessel interior attachments. This is based on a review of past NRC inspection reports, INPO evaluations, audits, and self-assessments that noted program effectiveness and implementation of corrective actions to improve performance.

Conclusion

Implementation of the MNGP BWR Vessel ID Attachment Welds Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.12 BWR Vessel Internals

Program Description

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 and approved ISI Relief Requests. 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.

NUREG-1801 Consistency

The BWR Vessel Internals Program is an existing program. It will be enhanced to be consistent, with certain exceptions, to the recommendation of NUREG-1801, Chapter XI, Program XI.M9, “BWR Vessel Internals.”

Exceptions to NUREG-1801

This subsection identifies the elements of the MNGP AMP that are not consistent with the corresponding NUREG-1801 AMP elements.

For further details, see the following element discussion(s) on the exceptions to NUREG-1801 aging management program elements:

- Preventive Actions

  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.

Enhancements

The following enhancement(s) are required to satisfy the NUREG-1801 aging management program recommendations. Details of the enhancements are included in the appropriate element descriptions below. Enhancements are scheduled for completion prior to the period of extended operation.

- Scope of Program

  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.

Aging Management Program Elements

The program elements, which are part of the MNGP BWR Vessel Internals Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M9, “BWR Vessel Internals,” are also provided.

Scope of Program

The scope of the MNGP BWR Vessel Internals Program is part of the MNGP ASME Section XI In-Service Inspection Program and provides for condition monitoring of the BWR vessel internals in accordance with the applicable ASME Section XI requirements and Table IWB-2500-1.

The MNGP in-vessel examination procedures monitor the effects of crack initiation and growth. These procedures are consistent with the recommendations of the BWRVIP guidelines for inspection and evaluation of reactor internal components and include the guidelines listed in the GALL Scope of Program element. However, Low Pressure Coolant Injection (LPCI) couplings are not used at MNGP (BWR-3), therefore BWRVIP-42 and -56 are not applicable.

The MNGP program mitigates the effects of SCC, IGSCC, and IASCC through the water chemistry programs. These programs are maintained consistent with the guidelines of BWRVIP-130.

Repair and replacement activities, if needed, are performed in accordance with the recommendations of the appropriate BWRVIP guideline.

The BWR Vessel Internals Program manages the aging effects for components of the following systems and structures:

Reactor Pressure Vessel Internals

Preventive Actions

The MNGP BWR Vessel Internals Program is a condition monitoring program that detects degradation of components before loss of intended function.

MNGP mitigates the potential for crack initiation and growth through the Plant Chemistry Program, which mitigates aging effects by controlling the reactor water chemical environment. The Plant Chemistry Program monitors and controls known detrimental contaminants such as chlorides, dissolved oxygen, and sulfate concentrations in accordance with MNGP chemistry limits and sampling frequencies, described in MNGP chemistry procedures and BWRVIP guidelines. The BWR water chemistry is controlled using BWRVIP-130 (TR-1008192): BWR Water Chemistry Guidelines - 2004 Revision.

BWRVIP-29 (TR-103515), BWR Water Chemistry Guidelines - 1993 Revision, is referenced in NUREG-1801, Chapter XI, Program XI.M9.

In the "Safety Evaluation Report Related to the License Renewal of Peach Bottom Atomic Power Station, Units 2 and 3" (NUREG-1769, Accession Number ML030300673), the NRC found the provisions of BWRVIP-79 (TR-103515-R2), BWR Water Chemistry Guidelines - 2000 Revision, acceptable because the program is based on updated industry experience. BWRVIP-130 (TR-1008192) is the current update of the BWR Water Chemistry Guidelines and supersedes BWRVIP-79 (TR-103515-R2). BWRVIP-130 is based on updated industry experience, with increased emphasis on fuel performance concerns, while retaining chemistry parameters, action levels and associated measurement frequencies essentially unchanged.

Parameters Monitored or Inspected

The aging effect that is monitored/inspected with the MNGP BWR Vessel Internals Program is crack initiation and growth. The MNGP BWR Vessel Internals Program is a condition monitoring program that detects and sizes flaws and defects by implementing the examination and inspection requirements of ASME Section XI.

The MNGP in-vessel examination procedures direct monitoring for the effects of cracking through inspection of the internal components. The inspections are performed consistent with the recommendations of the BWRVIP guidelines, as described in MNGP procedures, as well as the requirements of the ASME Code.

No relief has been requested for vessel internal components with hydrogen water chemistry per the guidelines of BWRVIP-62.

Detection of Aging Effects

The detection of aging effects is prescribed by the MNGP BWR Vessel Internals Program in accordance with the requirements of ASME Section XI to ensure that aging effects will be discovered and repaired before the loss of intended function. The nondestructive detection techniques used are the ultrasonic (UT) volumetric, surface, and visual examination methods to detect discontinuities, flaws, and defects within the material susceptible to crack initiation and growth. The extent, schedule, technique, and personnel qualifications for the examinations are rigorously identified within the program.

For reactor internal components, periodic inspections are performed in accordance with the MNGP in vessel examination procedures.

Prior to each outage, the necessary inspections are determined based on the BWRVIP guidelines and the ASME Code, as implemented by MNGP procedures. The examination procedures also identify the type and location of examination required for each component (VT-1, EVT-1, or VT-3), as well as the basis for the inspection (BWRVIP, ASME Code or design requirement). The specified examinations are consistent with the requirements of the BWRVIP guidelines and the requirements of the ASME Code.

Monitoring and Trending

The monitoring and trending of vessel internal age related degradation is prescribed in the MNGP BWR Vessel Internals Program. The program requirements for inspection schedule, extent, frequency, sequence of examinations, re-examinations, and additional examinations are in accordance with ASME Section XI, Article IWB-2000.

The requirements of ASME Section XI including the schedule requirements of IWB-2400 have been incorporated into the MNGP BWR Vessel Internals Program. If defects are detected, the scope of examination is expanded per the requirements of IWB-2430 with the guidelines of the applicable and approved BWRVIP documents.

The inspections to be performed at each refuel outage are determined by review of the BWRVIP guidelines and ASME Section XI, as well as past ISI experience, per MNGP procedure. Evaluation of flaws is conducted consistent with the BWRVIP guidelines.

Acceptance Criteria

The MNGP BWR Vessel Internals Program prescribes the acceptance criteria for the vessel internals. The program requirements for acceptance, rejection, and analytical evaluation are in accordance with ASME Section XI, Article IWB-3000.

Evaluation and disposition of indications are conducted consistent with the BWRVIP guidelines or ASME Code, as appropriate. This is documented in MNGP procedures. Evaluation of crack growth is in accordance with Article IWB-3000 of ASME Section XI with guidance from BWRVIP-14, BWRVIP-59, and BWRVIP-60.

When a flaw exceeds the acceptance standards of IWB-3500 or the applicable BWRVIP guideline, corrective action is initiated in accordance with applicable MNGP procedures. An Analytical Evaluation is performed in accordance with IWB-3000 and MNGP procedures.

Corrective Actions

Repair and replacement procedures include the requirements in ASME Section XI and the applicable and approved BWRVIP guidelines.

Refer also to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

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 inspections 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 BWR Vessel Internals Program has detected aging degradation and implemented appropriate corrective actions.

The program has demonstrated on several occasions that it provides reasonable assurance that aging effects are being managed for the BWR vessel internals. This is based on a review of past NRC inspection reports, INPO evaluations, audits, and self-assessments that noted program effectiveness and implementation of corrective actions to improve performance.

Conclusion

Implementation of the MNGP BWR Vessel Internals Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.13 Closed-Cycle Cooling Water

Program Description

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 (Reference 6), vendor recommendations, and plant operating experience. EPRI TR-1007820 is the current revision (Revision 1) of EPRI-107396. As only minor changes were made to the MNGP Closed-Cycle Cooling Water System Program to implement EPRI TR-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. A review of plant operating experience demonstrates these measures ensure closed-cycle cooling water (CCCW) systems are performing their intended functions.

The MNGP has four systems in License Renewal Scope that meet the definition for consideration as closed-cycle cooling water systems and portions of three additional systems (heat exchangers or coolers) that are serviced directly by these cooling water systems. These systems and portions of systems are not subject to significant sources of contamination, in which water chemistry is controlled and 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 but at sufficient intervals to detect the impact of aging effects on component function.

NUREG-1801 Consistency

The Closed-Cycle Cooling Water System Program is an existing program. It will be enhanced to be consistent, with certain exceptions, with the recommendations of NUREG-1801, Chapter XI, Program M21, Closed-Cycle Cooling Water System.

Exceptions to NUREG-1801

For further details on exceptions to NUREG-1801 aging management program elements, see the following program element discussions:

- Scope of Program

  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. In a similar situation with regard to the EPRI BWR Water Chemistry Guidelines the NRC found the provisions in the updated EPRI BWR Water Chemistry Guidelines to be acceptable. This is documented in the “Safety Evaluation Report to the License Renewal of Peach Bottom Atomic Power Station, Units 2 and 3" (NUREG-1769, Accession Number ML030300673), where the NRC found the provisions of the updated BWR Water Chemistry Guidelines acceptable because the revision was based on updated industry experience. The changes to the Closed Cooling Water Chemistry Guidelines are comparable in that they were also based on updated industry experience. Further, implementing EPRI TR-1008720 resulted in only minor program changes and the MNGP program generally meets the criteria of both revisions of the Closed Cooling Water Chemistry Guideline as described below.

- Preventive Actions

  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.

- Parameters Monitored or Inspected

  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.

- Acceptance Criteria

  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-1007820 or EPRI TR-107396. The ranges established, based on plant operating experience, have been sufficient to manage aging effects.

Enhancements

The following enhancement are required to satisfy the NUREG-1801 aging management program recommendations. Details of the enhancements are included in the appropriate program element description below. Enhancements are scheduled for completion prior to the period of extended operation.

- Parameters Monitored or Inspected

  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.

Aging Management Program Elements

The elements that are part of the MNGP Closed-Cycle Cooling Water System Program are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M21, are also provided.

Scope of Program

The following MNGP systems or portions of systems are in License Renewal scope and meet the definition for consideration as closed-cycle cooling water systems. They are:

- The Reactor Building Closed Cooling Water (RBC) System,
- The cooling loops for the Emergency Diesel Generators (EDGs) in the Emergency Diesel Generators (DGN) System,
- The piping and heating coils from the heating boiler in the Heating and Ventilation (HTV) System, and
- The closed cooling loop used on the #14 Air Compressor portion of the Instrument & Service Air (AIR) System.

Additionally, Monticello has portions of three other systems in License Renewal scope (heat exchangers and coolers) that are serviced directly by the RBC System:

- Residual Heat Removal (RHR) System RHR pump seal coolers,
- Reactor Recirculation (REC) System REC pump lower and upper seal coolers, and
- Control Rod Drive (CRD) System CRD pump thrust bearing coolers and CRD pump speed increaser lube oil heat exchangers.

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. Only the cooling loops for the DGN System perform a required heat transfer function in support of License Renewal. All other systems or portions of systems are in scope to satisfy non safety affecting safety criterion 10 CFR 54.4(a)(2). In these cases, loss of material due to corrosion, and in a few cases cracking, is managed to minimize the potential for leakage at specific locations of concern.

The Closed-Cycle Cooling Water Program manages the aging effects for components of the following systems and structures:

Control Rod Drive	Reactor Building Closed Cooling Water
Emergency Diesel Generators	Reactor Recirculation
Heating & Ventilation System	Residual Heat Removal
Instrument & Service Air	

Preventive Actions

This program, as applied to closed-cycle cooling water systems, relies on: (1) the use of appropriate materials and a water treatment program to inhibit cracking, corrosion, and heat exchanger fouling, and (2) testing and inspection to evaluate system and component performance and detect aging effects. Monitoring and control of water chemistry is used to minimize exposure to aggressive environments and application of corrosion inhibitors is used to mitigate general, crevice, and pitting corrosion.

The RBC System is comprised of carbon steel, copper alloy, and uses stainless steel in coils in the RHR and REC pump seal coolers and in instrument tubing lines. A chromate-based corrosion inhibitor is used in the system. Linings or coatings are not used. Consistent with EPRI TR-107396 guidelines for chemical control and diagnostics and EPRI TR-1007820 guidelines for chromate-based systems, pH, corrosion inhibitor concentration, and the presence of radionuclides (total gamma activity and counts per second) are periodically monitored and trended. An exception to EPRI TR-107396 and EPRI TR-1007820 is the plant range for chromate level (500-1800 ppm) is based on prior plant practices and exceeds the range recommended by EPRI. EPRI TR-107396 and EPRI TR-1007820 note higher concentrations may have an adverse impact on pump seal operation, however, the seals are a consumable of improved design and have not had an adverse impact on system pressure integrity. Other chemical parameters noted in EPRI TR-107396 for chemical treatment control and diagnostics and select diagnostic parameters of EPRI TR-1007820 are not monitored. Based on plant operating experience, chemical control and monitoring activities and RBC System performance have been acceptable without the use of these additional techniques. System design precludes the need to monitor some of these parameters (e.g., it does not interface with refrigerant systems) and operation and inspection activities preclude the need to monitor others (e.g., the system is chromate not nitrite-based; makeup water is from a demineralized water, not raw water, source; and continuous monitoring and periodic testing are preformed to detect leakage and monitor for corrosion and cracking).

The cooling loops of the EDG System are comprised of carbon steel, cast iron (water pumps) and copper alloy materials and utilizes both a nitrite-based corrosion inhibitor and a nitrogen containing organic compound (azole). Linings or coatings are not used. Consistent with EPRI TR-107396 guidelines for chemical control and diagnostics and EPRI TR-1007820 guidelines for nitrite/molybdate systems, pH, corrosion inhibitor concentration, conductivity, nitrate, alkalinity, total iron and copper, nitrates, ammonia, and tolytriazole are periodically monitored and trended. Chemical range for the corrosion inhibitor is identical to the typical range specified in Table 4-2 of EPRI TR-107396 and more restrictive than that specified in Table 5-3 of EPRI TR-1007820. Total organic carbon and the corrosion inhibitor to conductivity ratio are not measured, but total aerobic bacteria and sulfate reducing bacteria are monitored to detect microbiological growth. Corrosion inhibitor and conductivity are measured separately. Other chemistry parameters noted in EPRI TR-107396 and EPRI TR-1007820 are also not monitored. Based on plant operating experience, chemical control and monitoring activities and system performance have been acceptable without the use of these additional techniques. System design precludes the need to monitor some of the recommended parameters (e.g., it does not interface with refrigerant systems). Operation and inspection activities preclude the need to monitor others (e.g., makeup water is demineralized and periodic testing is performed to detect leaks and monitor performance).

The piping and heating coils of the HTV System are comprised of carbon steel, cast iron (water pumps), copper alloy materials, and stainless steel and utilizes a sulfite-based corrosion inhibitor. Linings or coatings are not used. Consistent with EPRI TR-107396 guidelines for chemical control and diagnostics and EPRI TR-1007820 technical basis of monitored parameters, pH, corrosion inhibitor concentration, conductivity, and the presence of radionuclides (total gamma activity) levels are periodically monitored. Chemical range for the corrosion inhibitor is established in accordance with vendor recommendations. EPRI TR-107396 and EPRI TR-1007820 do not discuss the use of sulfite as an oxygen de-aerator. Other chemical parameters noted in EPRI TR-107396 and EPRI TR-1007820 are not monitored nor is specific monitoring performed to detect microbiological growth. However, pH is maintained very high (11.5 to 12) thus minimizing the potential for growth. The system does not interface with refrigerant type coolants and the makeup water is from a demineralized water source. As discussed under the Parameters Monitored and Inspected program element, enhancements to the inspection program for this system are proposed to confirm the adequacy of chemistry control in minimizing the potential for corrosion.

The closed cooling loop used on the #14 Air Compressor (portion of the AIR System) is comprised of copper alloy, carbon steel (pumps) and stainless steel materials and utilizes an inhibited ethylene glycol solution. Linings or coating are not used. The solution contains a minor percentage of diethylene glycol. Consistent with EPRI TR-107396 Section 4.3.5 and EPRI TR-1007820 Section 5.9 on blended glycol formulations:

- pH is maintained basic and monitored on a periodic basis,·
- Tolyltriazole is at relatively high concentrations to help inhibit corrosion and glycol breakdown and is monitored on a periodic basis,
- The ethylene glycol concentration is maintained at approximately 50% which is well above the minimum concentration of 30% at which ethylene glycol can become a nutrient for microbiological growth, and
- Specific gravity (to monitor ethylene glycol concentration), conductivity, nitrite, and nitrate levels are monitored on a periodic basis.

Parameters Monitored or Inspected

Chemistry control and monitoring techniques are discussed in the Preventive Actions program element. Non-chemistry testing and inspection techniques, consistent with Section 5.7 of EPRI TR-107396 and Section 8.4 of EPRI TR-1007820, are used to determine the potential for:

- Loss of material or leakage caused by corrosion or stress corrosion cracking,
- Decreased flow capacity caused by corrosion and/or deposition (applies to EDG System cooling loops only), and
- Heat transfer degradation due to fouling (applies to EDG cooling loops only).

Monitoring techniques are those relied upon to monitor rate of corrosion, material condition, and the potential for failure. A number of non-chemical testing and inspection methods are recommended in EPRI TR-107396 and EPRI TR-1007820 for monitoring the effects of corrosion. Many of these methods are included in the MNGP program. Methods include inspection, non-destructive evaluation, leakage monitoring, and heat exchanger performance (heat transfer effectiveness) monitoring.

Portions of the RBC System included in License Renewal scope include the RBC heat exchangers and pumps, RHR System pump seal coolers, REC System pump lower and upper seal coolers, CRD System pump thrust bearing coolers, CRD System pump speed increaser lube oil heat exchangers, containment isolation valves, and select piping and other valves whose pressure integrity failure could adversely impact the operation of nearby safety related equipment. Consistent with NUREG-1801, monitored RBC System pump parameters include flow and discharge and suction pressure. As an exception to NUREG-1801, inlet RBC heat exchanger temperature is not monitored but outlet temperature and both inlet and outlet temperatures on the raw water side are measured. Also, individual temperature and pressure readings for the RHR and REC pump seal coolers are limited to select temperature and flow locations. RBC heat exchanger eddy current testing and internal inspections of the raw water side are performed on a periodic basis. Continuous monitoring of RBC surge tank level, various system temperatures and flow, and radionuclide levels are also available and alarm on out of range values.

These system and component monitoring techniques have been effective, based on plant operating experience, in managing the effects of corrosion on RBC System components included in the scope of License Renewal. Additionally, ultrasonic test measurements of pipe wall thickness to determine the extent of corrosion on select portions of RBC System piping inside the drywell were performed which confirmed the effectiveness of chemistry. The measurements included piping connected to the REC System pump seal coolers. However, no direct inspection for confirming 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 has been performed. As an enhancement, 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.

For the cooling loops of the EDG System, non-chemical performance monitoring methods are used to confirm the effectiveness of chemistry in mitigating corrosion. As an exception to NUREG-1801, the EDG 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 EDG operability tests. As part of the 12 year preventive maintenance requirements for the EDGs, 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). As an exception to NUREG-1801, differential pressure across the EDG coolant heat exchangers is not monitored, but heat exchanger performance testing is performed on a periodic basis by gathering temperature and flow results. Eddy current testing is also performed periodically. These testing methods, combined with chemical control and monitoring, have been effective in managing corrosion aging effects based on plant operating experience.

Chemistry control and monitoring effectively manage aging effects of the piping and heating coils of the HTV System. As an exception to NUREG-1801, system and component performance monitoring is not performed. The recommended pump performance parameters are not monitored, and the system contains no heat exchangers. The system contains a number of heating coils as it provides heating to various plant locations. Only select portions of the are included in License Renewal scope for their pressure integrity function only. Some of the heating coils are visually inspected for leaks on a periodic basis. Based on plant operating experience, chemistry control and inspection practices to date of the piping and heating coils have been effective in minimizing the impacts of corrosion and system leakage. As an enhancement to the program, a one time inspection will be performed to monitor the effects of corrosion in select portions of the system within the scope of License Renewal.

In addition to chemistry checks and coolant additions as needed, periodic non-chemical monitoring techniques are used to evaluate performance of the closed cooling loop used for the #14 Air Compressor. Ethylene glycol is used for the heat transfer medium with a radiator and fan for heat rejection. Though the heat transfer function is not in scope for License Renewal, many of the same periodic monitoring techniques can be used to detect leakage or performance degradation that may ultimately impact the License Renewal pressure boundary function. In addition to a local low coolant flow alarm, a number of parameters are monitored and logged on a routine basis including coolant pump suction and discharge pressure, coolant and oil levels, and various coolant and compressor temperatures and pressures. As part of periodic compressor maintenance activities, visual inspections of the intercooler, aftercooler, oil cooler, and cooling unit are performed to identify leaks or corrosion. Depending on performance trends, the coolant (internal) side of the various coolers may require inspection and cleaning. Reduced heat transfer performance (from temperature monitoring results) can also be indicative of internal corrosion.

Detection of Aging Effects

Both continuous operation and standby systems are included in the Closed-Cycle Cooling Water System Program. Corrosion inhibitors and chemical control and monitoring are used to minimize the potential for cracking and corrosion and to minimize the potential for heat transfer degradation in the EDG cooling loops. Performance monitoring and trending of key system and component parameters (e.g., temperature, pressure, flow) are used to confirm the effectiveness of chemistry for continuously operating systems. Periodic testing and inspection (e.g., heat exchanger eddy current testing and visual checks for leaks) are performed for standby systems. The extent and schedule of inspections, tests and types of performance monitoring activities implemented are in accordance with EPRI TR-107396 and TR-1007820, with a few exceptions as noted above. In those cases where exceptions are noted, alternate methods of monitoring are used. Plant operating experience has demonstrated these techniques are effective. A one time inspection will be performed to monitor the effects of corrosion in these areas where prior ultrasonic testing was not performed.

The RBC System is a continuously operating system. Control and monitoring includes the use of corrosion inhibitors, chemical control and monitoring, monitoring and logging heat exchanger and pump performance on a routine basis, monitoring containment isolation valve performance, pressure integrity evaluations as part of integrated leak rate testing and in-service testing, continuous monitoring of surge tank level (high/low alarm), monitoring of RBC temperatures and exit flow from the REC System pump seal coolers, past ultrasonic testing on select system piping locations inside the drywell, and use of a one time inspection.

The Emergency Diesel Generators are typically in standby (not operating) but periodically tested to ensure operability. For the EDG cooling loops, control and monitoring includes the use of corrosion inhibitors, chemical control and monitoring, EDG coolant heat exchanger performance and eddy current testing, lube oil cooler internal (water side) inspections, and monitoring key system performance parameters on a quarterly basis during tests. One time inspections are not proposed for this system as it is inspected for leaks every 12 years as part of EDG preventive maintenance and more frequently by monitoring heat exchanger performance and coolant levels.

The piping and heating coils of the HTV System are in continuous operation on a seasonal basis. Aging management includes the use of corrosion inhibitors, chemical control and monitoring, periodic visual inspection of select heating coils, and use of a one time inspection.

The closed cooling loop used on the #14 Air Compressor is a continuously operating loop. Controls and monitoring include the use of an inhibited ethylene glycol coolant, chemical monitoring and coolant additions, and monitoring and logging temperatures, levels, and pressures on a routine basis. Trending is used to define when internal inspections of coolers should be performed.

Monitoring and Trending

Frequency of chemistry monitoring activities is specified by plant procedure. Sampling is performed on a periodic basis for the RBC System, EDG System cooling loops, piping and heating coils of the HTV System, and closed cooling loop of the #14 Air Compressor of the AIR System. Established frequencies are based on EPRI TR-107396 and TR-1007820 guidance and vendor recommendations. These frequencies may vary based on plant operating conditions or equipment performance trends.

When limits are not met, plant procedures require the initiation of corrective actions to correct the condition. Corrective actions are initiated through the site Corrective Action Program. Follow-up (increased) sampling and analysis actions are performed when required as part of evaluating corrective action effectiveness. Procedures require review of work performed to assure adequate resolution of the issue and verification of the effectiveness of corrective actions.

Frequency of performance and functional tests are consistent with EPRI TR-107396 and TR-1007820 and are based on plant operating experience, trends and equipment performance. System and component operability tests are typically performed on a more frequent basis than once per cycle whereas more intrusive inspections (disassembly, eddy current testing, etc.) are performed less frequently but at sufficient intervals to detect the impact of aging effects.

Acceptance Criteria

Corrosion inhibitor and coolant concentrations are maintained within limits based on a combination of EPRI TR-1007820 guidelines, vendor recommendations, and plant experience. System and component performance test results are evaluated in accordance with the guidelines of EPRI TR-1007820 and used as a basis for evaluating the effectiveness of actions to mitigate corrosion, cracking, and heat transfer degradation. 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 EPRI TR-107396 and TR-1007820. Others are based on vendor recommendations and plant experience.

For the RBC System, chromate is monitored to a range of 500 to 1800 ppm (not 150 to 300 ppm as recommended by EPRI TR-107396 and 1007820). As noted in EPRI TR-107396 and TR-1007820, this may have an impact on pump seal integrity. The RBC pump seals are consumables and impacts to system pressure integrity have not been noted. A new design seal was installed that is replaced on a periodic basis that appears to effectively address any leakage concerns.

For the cooling loops of the EDG System, the chemical range for nitrite is identical to EPRI TR-107396 (500 to 1,000 ppm) and more restrictive than EPRI TR-1007820 (50 to 1,500 ppm). The range for pH is 9.0 to 10.7 (which is more restrictive than 8.5 to 10.5 in EPRI TR-107396 and 8.5 to 11.0 in EPRI TR-1007820) and for tolyltriazole is 10 to 40 ppm (not 5 to 30 ppm in EPRI TR-107396 and more restrictive than 5 to 100 ppm in EPRI TR-1007820). No adverse impacts for slightly higher ranges for tolytriazole were noted in EPRI TR-107396.

For the piping and heating coils of the HTV System, chemical ranges are monitored in accordance with vendor recommendations and plant experience and are not specified by EPRI TR-107396 or EPRI TR-1007820. These include conductivity, pH, phosphate, sulfites, and total gamma activity and are specified by plant procedure.

For the closed cooling loop of the #14 Air Compressor, chemical ranges are monitored for trending purposes and are based on plant experience. Both Section EPRI TR-107396 and EPRI TR-1007820 recommend the glycol percent volume remain above 30% to avoid becoming a nutrient for microbiological growth. The concentration at Monticello is maintained at approximately 50%.

As noted previously, a one time inspection will be performed to monitor the effects of corrosion in License Renewal portions of the RBC System and piping and heating coils of the HTV System.

Corrective Actions

Guidelines for water chemistry monitoring frequency are contained in plant procedures. Sampling is performed on a periodic basis for the RBC System, cooling loops of the EDG System, piping and heating coils of the HTV System, and coolant loop of the #14 Air Compressor of the AIR System. Established frequencies are based on EPRI TR-1007820 guidance, vendor recommendations, and plant operating experience. These frequencies may vary based on plant operating conditions or established trends. When limits are not met, plant procedures require the initiation of corrective actions to correct the condition. Corrective actions are initiated through the site Corrective Action Program. Timeliness of corrective actions is consistent with EPRI TR-1007820 Action Levels and are based on the significance of the out of tolerance value and potential impact on equipment performance. Follow-up (increased) sampling and analysis actions are performed when required as part of evaluating corrective action effectiveness. Plant procedures require review of work performed to assure adequate resolution of the issue and verification of the effectiveness of corrective actions.

Frequency of performance and functional tests are consistent with EPRI TR-107396 and EPRI TR-1007820 and are based on plant operating experience, trends and equipment performance. System and component operability tests are typically performed on a more frequent basis than once per cycle whereas more intrusive inspections (disassembly, eddy current testing, etc.) are performed less frequently but at sufficient intervals to detect the impact of aging effects on component function.

Also refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

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

Procedural requirements for chemistry limits are established based on EPRI and industry standards and routinely monitored. Recent external and internal assessments have identified chemistry trending as a strength and personnel knowledge as good.

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 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.

Conclusion

Implementation of the MNGP Closed-Cycle Cooling Water System Program will provide reasonable assurance that the aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B2.1.14 Compressed Air Monitoring

Program Description

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.

NUREG-1801 Consistency

The MNGP Compressed Air Monitoring Program is an existing program. It will be enhanced to be consistent, with certain exceptions, with the recommendations of NUREG-1801, Chapter XI, Program XI.M24, “Compressed Air Monitoring.”

Exceptions to NUREG-1801

For further details, see the following element discussion(s) on the exceptions to NUREG-1801 aging management program elements:

- Parameters Monitored/Inspected

  In-Service Inspection (ISI) and In-Service Testing (IST) is 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.

- Detection of Aging Effects

  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. In the “Safety Evaluation Report - Related to the License Renewal of the Dresden Nuclear Power Station, Units 2 and 3, and the Quad Cities Nuclear Power Station, Units 1 and 2" (Accession Number ML042050507), the NRC found use of ANSI/ISA-S7.3-1975 acceptable because it is more conservative than ANSI/ISA-S7.0.01-1996.

  MNGP takes exception to ASME OM-S/G-1998, Part 17 as specified in NUREG-1801, XI.M24. In the “Safety Evaluation Report - Related to the License Renewal of the Dresden Nuclear Power Station, Units 2 and 3, and the Quad Cities Nuclear Power Station, Units 1 and 2" (Accession Number ML042050507), the NRC found this acceptable because the instrument air system compressors, receivers, filters, and dryers are not within the scope of license renewal, therefore, the instrument air systems do not require performance testing for aging management.

Enhancements

The following enhancement(s) are required to satisfy the NUREG-1801 aging management program recommendations. Details of the enhancements are included in the appropriate element descriptions below. Enhancements are scheduled for completion prior to the period of extended operation.

- Scope of Program

  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.

- Detection of Aging Effects

  The MNGP Compressed Air Monitoring Program will be revised to include inspection of air distribution piping based on the recommendations of EPRI TR-108147.

Aging Management Program Elements

The elements, which are part of the Compressed Air Monitoring Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M24, “Compressed Air Monitoring,” are also provided.

Scope of Program

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 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.

MNGP's Compressed Air Monitoring Program will be enhanced to include corrective action requirements if the acceptance limits for water vapor, oil content, and particulate are not met. Program enhancements will also clarify the acceptance criteria for the oil content testing and the basis for the acceptance limits for the water vapor, oil content, and particulate tests.

The Compressed Air Monitoring Program manages the aging effects for components of the following systems and structures:

Instrument & Service Air System

Preventive Actions

MNGP's Compressed Air Monitoring Program maintains system air quality by implementing plant procedures and instructions that control testing and inspection of the air system.

Preventive maintenance, along with other procedures and instructions, address issues of corrosion and the presence of oil, water, rust, and other contaminants. Industry guidance and manufacturer's recommendations provide the primary guidance for MNGP procedures to control the levels of contaminants and ensure required air quality in the Instrument and Service Air System.

Parameters Monitored or Inspected

MNGP's Compressed Air Monitoring Program contains requirements to test the instrument air for water vapor, oil content, and particulate. These tests manage the presence of unacceptable levels of contaminants and ensure instrument air quality. Other preventive maintenance procedures for the compressors and air dryers include inspection requirements for corrosion.

MNGP takes an exception to the guidance in NUREG-1801 in that In-Service Inspection (ISI) and Testing (IST) is 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. In lieu of this guidance, MNGP uses established program procedures to verify proper air quality to ensure that the intended function of the air system is maintained. Maintenance practices, emergency procedures, and training are controlled via station administrative and training procedures.

This is acceptable because the MNGP Compressed Air Monitoring Program procedures provide an equivalent level of guidance to that provided in NUREG-1801 to verify proper air quality and preventative maintenance to ensure that the intended function of the air system is maintained.

Detection of Aging Effects

The MNGP Compressed Air Monitoring Program ensures timely detection of Instrument and Service Air System degradation. Preventive maintenance, along with other procedures and instructions, address issues of corrosion, leakage, and contamination, thus helping to ensure timely detection of system function degradation.

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.

Exception is taken to ANSI/ISA-S7.0.01-1996 because MNGP uses ANSI/ISA-S7.3-1975. In the “Safety Evaluation Report - Related to the License Renewal of the Dresden Nuclear Power Station, Units 2 and 3, and the Quad Cities Nuclear Power Station, Units 1 and 2" (Accession Number ML042050507), the NRC found use of ANSI/ISA-S7.3-1975 acceptable because it is more conservative than ANSI/ISA-S7.0.01-1996.

Exception is taken to ASME OM-S/G-1998, Part 17 as specified in NUREG-1801, XI.M24. In the “Safety Evaluation Report - Related to the License Renewal of the Dresden Nuclear Power Station, Units 2 and 3, and the Quad Cities Nuclear Power Station, Units 1 and 2" (Accession Number ML042050507), the NRC found this acceptable because the instrument air system compressors, receivers, filters, and dryers are not within the scope of license renewal, therefore, the instrument air systems do not require performance testing for aging management.

This is acceptable because the MNGP Compressed Air Monitoring Program procedures provide an equivalent level of guidance to that provided in NUREG-1801 to ensure timely detection of degradation of the compressed air system function.

Monitoring and Trending

The MNGP Compressed Air Monitoring Program monitors the effects of corrosion through various procedures and instructions. This is accomplished by visual inspections during walkdowns of the system and individual items of equipment. Preventive maintenance procedures require periodic inspection of the system piping, compressors and air dryers. The presence of contaminants is monitored by performance of an air quality testing procedure.

Acceptance Criteria

Procedures for the MNGP Compressed Air Monitoring Program contain acceptance requirements per ANSI/ISA S7.3, Quality Standard for Instrument Air, for water vapor, oil content, and particulate tests. Other Instrument and Service Air System inspection procedures require visual inspection and criteria for corrective action.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

The Compressed Air Monitoring Program has been effective in monitoring Instrument and Service Air System performance and, as enhanced, will effectively manage aging effects due to corrosion. The program is based on appropriate NRC requirements and industry guidance, including MNGP's response to NRC GL 88-14. Established preventive maintenance tasks and other inspections are performed on a routine basis. For example, a major preventive maintenance task was performed and completed in June of 2003. A number of system leaks were identified, the System Engineer was notified, and repair work orders were initiated and completed to repair the leaks. Preventive maintenance and inspections, system repairs, ongoing monitoring, and review of plant and industry operating experience have been effective in maintaining air system performance. Unavailability targets for this system are well within established goals.

Conclusion

Implementation of the MNGP Compressed Air Monitoring Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.15 Electrical Cables & Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Program

Program Description

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 manages 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.

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.

As stated in NUREG/CR-5643, “The major concern with cables is the performance of aged cable when it is exposed to accident conditions." The statement of considerations for the final license renewal rule (60 Fed. Reg. 22477) states, "The major concern is that failures of deteriorated cable systems (cables, connections, and penetrations) might be induced during accident conditions." 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.

The program provides reasonable assurance that the intended functions of electrical cables and connections within scope of license renewal that are not subject to the environmental qualification requirements of 10 CFR 50.49 and are exposed to adverse localized environments caused by heat, radiation, or moisture are maintained consistent with the current licensing basis through the period of extended operation. This program considers the technical information and guidance provided in NUREG/CR-5643, IEEE Std. P1205-2000, SAND96-0344 (Reference 7), and EPRI TR-109619 (Reference 8).

The program addresses cables and connections whose configuration is such that most cables and connections installed in adverse localized environments are accessible. This program is a sampling program in which selected cables and connections from accessible areas are inspected and represent, with reasonable assurance, all cables and connections in the adverse localized environments. If an unacceptable condition or situation is identified for a cable or connection in the inspection sample, a determination is made as to whether the same condition or situation is applicable to other accessible or inaccessible cables or connections.

NUREG-1801 Consistency

The MNGP Electrical Cables & Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements Program is a new program. It will be consistent with the recommendations of NUREG-1801 Chapter XI, Program XI.E1.

Exceptions to NUREG-1801

None.

Enhancements

None.

Aging Management Program Elements

The program elements, which are part of the Electrical Cables & Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements Program, are described below. The results of an evaluation of each element against NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Chapter XI, Program XI.E1, Electrical Cables and Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements, are also provided.

Scope of Program

The Electrical Cables & Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements Program manages the aging effects for cables and connections of systems that have been identified as within scope of License Renewal Activities.

The program applies to accessible non-EQ electrical cable and connections, including control and instrumentation cables, within the scope of license renewal, that are installed in adverse localized environments caused by heat, radiation, or moisture in the presence of oxygen. MNGP has not identified any fuse holders outside the enclosure of an active component that require aging management. However, should such fuse holders be identified in the future, they would be appropriately managed within the program to address the concerns identified in ISG-5.

Preventive Actions

This is an inspection program and no actions are taken as part of this program to prevent or mitigate aging degradation

Parameters Monitored or Inspected

A representative sample of accessible electrical cables and connections installed in adverse localized environments are visually inspected for cable and connection jacket surface anomalies, such as embrittlement, discoloration, swelling, cracking, or surface contamination.

The sample is based on the severity of the adverse localized environment, as compared to the plant design environment, and other criteria such as accessibility, availability, importance-to-safety, or prior inspection results.

Detection of Aging Effects

Surface anomalies are a precursor indication of insulation degradation. Conductor insulation aging degradation from heat, radiation, or moisture in the presence of oxygen causes cable jacket and connection surface anomalies. A representative sample of accessible electrical cables and connections are visually inspected for surface anomalies, such as embrittlement, discoloration, swelling, cracking, or surface contamination. Guidelines provided in EPRI TR-109619 may be used as an aid in the identification of undesirable conditions. If an unacceptable condition is identified for a cable or connection in the inspection sample, then a determination based on applicable statistical analysis methods will be made as to whether the same condition or situation is applicable to other accessible or inaccessible cable or connections. Additional inspections will be performed as required by the analysis.

A representative sample of accessible electrical cables and connections installed in adverse localized environments are visually inspected at least once every 10 years. As stated in NUREG-1801, this is an adequate inspection period to preclude failures of the conductor insulation, since experience has shown that aging degradation is a slow process. The first inspection for license renewal is to be completed before the period of extended operation.

Monitoring and Trending

Trending actions are not included as part of this program because the ability to trend inspection results is limited and dependent on the specific types of cable materials inspected and is highly subjective.

Acceptance Criteria

The accessible cables and connections are to be free from unacceptable, visual indications of surface anomalies, which suggest that conductor insulation or connection degradation exists. An unacceptable indication is defined as a noted condition or situation that, if left unmanaged, could lead to a loss of the intended function

Corrective Actions

All unacceptable visual indications of cable and connection jacket surface anomalies will be documented in the MNGP Corrective Action Program. Documented anomalies are subject to an engineering evaluation. Such evaluations consider the age and operating environment of the component, as well as the severity of the anomaly and whether such an anomaly has previously been correlated to degradation of conductor insulation or connections. Corrective actions may include, but are not limited to, testing, shielding or otherwise changing the environment, or relocation or replacement of the affected cable or connection. When an unacceptable anomaly is identified, a determination is made as to whether the same condition or situation is applicable to other accessible or inaccessible cables or connections.

Refer also to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

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.

Conclusion

Implementation of the MNGP Electrical Cables & Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation. The program will be implemented prior to the period of extended operation.

B2.1.16 Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits

Program Description

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.

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.

In most areas within a nuclear power 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. Conductor insulation materials used in electrical cables may degrade more rapidly than expected in these adverse localized environments. An adverse localized environment is a condition in a limited plant area that is significantly more severe than the specified service environment for the cable. 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.

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.

The purpose of the aging management program is to provide reasonable assurance that the intended functions of electrical cables that are not subject to the environmental qualification requirements of 10 CFR 50.49 and are used in circuits with sensitive, low-level signals exposed to adverse localized environments caused by heat, radiation or moisture will be maintained consistent with the current licensing basis through the period of extended operation. This program considers the technical information and guidance provided in NUREG/CR-5643, IEEE Std. P1205, SAND96-0344, and EPRI TR-109619.

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.

As stated in NUREG/CR-5643, "The major concern with cables is the performance of aged cable when it is exposed to accident conditions." The statement of considerations for the final license renewal rule (60 Fed. Reg. 22477) states, "The major concern is that failures of deteriorated cable systems (cables, connections, and penetrations) might be induced during accident conditions." Since they are not subject to the environmental qualification requirements of 10 CFR 50.49, the electrical cables 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.

NUREG-1801 Consistency

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

Exceptions to NUREG-1801

For further details on exceptions to NUREG-1801 aging management program elements, see the specific element discussion(s) for this AMP:

- Parameters Monitored or Inspected

  The surveillance tests required by the MNGP Technical Specification either do not include all cable within 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. This testing meets the intent of NUREG-1801.

- Detection of Aging Effects

  The surveillance tests required by the MNGP Technical Specification either do not include all cable within 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. This testing meets the intent of NUREG-1801.

- Acceptance Criteria

  The surveillance tests required by the MNGP Technical Specification either do not include all cable within 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. This testing meets the intent of NUREG-1801.

Enhancements

None.

Aging Management Program Elements

The elements, which are part of the Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program are described below. The results of an evaluation of each element against NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Chapter XI, Program XI.E2, "Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits," are also provided.

Scope of Program

The Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program manages the aging effects for cables and connections of systems that have been identified as within scope of license renewal activities. This program applies to electrical cables used in circuits with sensitive, low-level signals of the following systems:

Neutron Monitoring	Radiation Monitoring

Preventive Actions

This is a testing program and no actions are taken as part of this program to prevent or mitigate aging degradation.

Parameters Monitored or Inspected

Radiation Monitoring and Nuclear instrumentation circuits are periodically tested to provide an indication of the condition of cable insulation.

When available in existing surveillance test procedures, the parameters monitored are determined from the plant technical specifications and are specific to the instrumentation loop being calibrated, as documented in the corresponding surveillance test procedure.

For those cables not tested as part of Technical Specification surveillance procedure, the Program will periodically test the cable insulation. The specific type of test performed is determined prior to testing and is capable of detecting a significant reduction in cable insulation resistance. This testing meets the intent of NUREG-1801.

Detection of Aging Effects

Cables, in the Radiation Monitoring and Neutron Monitoring Systems, are tested on a regular schedule. The testing may be part of a routine instrument calibration or a test specifically designed to test the insulation resistance of the cable itself.

Calibration provides sufficient indication of the need for corrective actions by monitoring key parameters 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. A review of the calibration and testing results can provide an indication of the existence of aging effects. By reviewing the results obtained during normal calibration testing or the results from dedicated insulation resistance testing, it may be possible to detect severe aging degradation prior to the loss of the intended function of the cable and connection. All calibration results that fail to meet acceptance criteria will be reviewed for aging effects.

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.

The first test shall be completed prior to the end of the initial 40-year license term. The test frequency, of these cables shall be determined by MNGP based on engineering evaluation not to exceed ten years.

Monitoring and Trending

Trending actions are not included as part of this program because the ability to trend test results is limited and dependent on the specific types of cable materials inspected and is highly subjective.

Acceptance Criteria

The NUREG-1801 element indicates that calibration readings are to be within the loop-specific acceptance criteria, as set out in the plant technical specifications surveillance test procedures. However, the technical specifications surveillance test procedures at MNGP may not include the cable. For these cables, 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. The acceptance criteria is defined by the specific type of test performed and the specific cable tested.

Corrective Actions

Corrective actions such as recalibration and circuit trouble-shooting are implemented when an instrument loop is found to be out of calibration or when insulation resistance readings are unacceptable.

Refer also to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

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 in-house operating experience.

Conclusion

Implementation of the MNGP Electrical Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation. The program will be implemented prior to the period of extended operation.

B2.1.17 Fire Protection

Program Description

For license renewal purposes the MNGP Fire Protection Program includes a fire barrier inspection program, a diesel-driven fire pump inspection program, and a halon fire suppression system inspection.

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

The diesel-driven fire pump inspection program requires that the pump be periodically tested and the diesel engine inspected to ensure that the fuel supply line can perform the intended function.

The halon fire suppression system inspection included periodic inspection and testing of the cable spreading room halon fire suppression system.

NUREG-1801 Consistency

The Fire Protection Program is an existing program. It will be enhanced to be consistent, with certain exceptions, with NUREG-1801, Chapter XI, Program M26, Fire Protection as modified by ISG-04.

Exceptions to NUREG-1801

For further details, see the following element discussion on the exceptions to NUREG-1801 aging management program elements:

- Parameters Monitored or Inspected

  Periodic visual inspection and function test of halon systems at least once every six months.

  The Cable Spreading Room Halon System is functionally tested and visually inspected every 18 months instead of every six months as recommended in NUREG-1801, XI.M26.

Enhancements

The following enhancements are required to satisfy the NUREG-1801 aging management program recommendations. Details of the enhancements are included in the appropriate element description below. Enhancements are scheduled for implementation prior to the period of extended operation.

- Detection of Aging Effects

  The existing MNGP Fire Protection Program cable spreading room halon visual inspection procedure will be revised to include inspection to detect any signs of degradation, such as corrosion and mechanical damage. This visual inspection will provide aging management for external surfaces of the cable spreading room halon fire suppression system.

  The fire protection program plan document will be revised to include qualification criteria for individuals performing visual inspections of penetration seals, fire barriers, and fire doors. The qualification criteria will be in accordance with VT-1 or equivalent and VT-3 or equivalent as applicable.

Aging Management Program Elements

The elements, which are part of the MNGP Fire Protection Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M26, Fire Protection are also provided.

Scope of Program

The Fire Protection Program is credited for detecting and managing age-related degradation of fire barrier walls, ceilings, and floors, penetration seals, fire doors, and halon fire suppression system components. It also manages the aging effects on the intended function of the fuel supply line for the diesel fire pump.

The Fire Protection Program manages the aging effects for components of the following systems and structures:

Emergency Diesel Generator Building	Plant Control and Cable Spreading Structure
Emergency Filtration Train Building	Reactor Building
Fire	Structures Affecting Safety
Fire Protection Barriers	Turbine Building
Intake Structure (Including Access Tunnel and Diesel Fir Pump House)	

Preventive Actions

The MNGP Fire Protection Program employs a systematic approach to defense-in-depth fire protection provided via a fire hazard analysis, design features, administrative controls, and implementing procedures. The procedures and technical manuals developed to implement the program specify measures for fire prevention, detection, containment, suppression, and achieving post-fire plant shutdown for each area within license renewal scope.

Parameters Monitored or Inspected

Procedures are established to inspect penetration seals, fire barriers, and fire doors. During testing, the diesel-driven fire pump is observed and monitored, by procedure, for indications of degradation.

The Cable Spreading Room Halon System is functionally tested and visually inspected every 18 months instead of the every six months as recommended in NUREG-1801, XI.M26. 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 licensing basis. Although the surveillance interval is specified in the Operations Manual, it is historically traceable to the Technical

Specifications, having resided there until removal under the guidelines of Generic Letters 86-10 and 88-12.

Detection of Aging Effects

The MNGP Fire Protection Program procedures are established to inspect penetration seals, fire barriers, and associated fire doors. Procedures also place the diesel-driven fire pump under observation when tested. The Cable Spreading Room halon system is subject to both inspection and functional testing. The technical attributes of the procedure inspection /test criteria assure potential aging affects of these commodities are detected prior to loss of function.

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.

Monitoring and Trending

Procedures are established to inspect penetration seals, fire barriers, and associated fire doors. Procedures also place the diesel-driven fire pump under observation when tested. The Cable Spreading Room halon system is subject to both inspection and functional testing.

The parameters inspected or monitored through implementation of the procedures assure potential aging affects of these commodities are detected prior to loss of function.

Acceptance Criteria

Procedures associated with inspection or testing penetration seals, fire barriers, fire doors, the Cable Spreading Room halon system, and the diesel-driven fire pump as appropriate contain specific acceptance criteria. The acceptance criteria will assure aging affects of these commodities are detected prior to loss of function.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

The Fire Protection Program has been effective in managing the aging effects of fire protection features and barriers. Through the use of established plant surveillances and procedures, barriers and other features are inspected on a periodic basis. Recent assessments have noted the overall material condition as good. For example, the December 2000 self-assessment utilizing industry guidance (Nuclear Energy Institute Self-Assessment Guide 99-05) concluded the observed seals and fireproofing appeared in good condition. Problems are documented and resolved through the site Corrective Action Program.

Prior issues noted with program performance during the NRC 2002 inspection were entered into the site Correction Action Program for assessment and resolution. MNGP implemented a number of extensive corrective actions to improve program performance, including improved identification and resolution of deficiencies. An extensive self-assessment was performed in March 2004 to evaluate progress and program compliance. Though some areas of vulnerability were noted for correction and continued focus, a number of program strengths were identified and the assessment concluded the MNGP program is consistent with corporate directive requirements and had made significant progress in addressing 2002 inspection findings.

Conclusion

Implementation of the MNGP Fire Protection Program provides reasonable assurance that aging effects are managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.18 Fire Water System

Program Description

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. The system is also normally maintained at required operating pressure and is monitored such that loss of system pressure is immediately detected and corrective actions initiated.

NUREG-1801 Consistency

The MNGP Fire Water System Program is an existing program. It will be enhanced to be consistent with the recommendations of NUREG-1801 Chapter XI, Program XI.M27, as modified by ISG-04.

Exceptions to NUREG-1801

None.

Enhancements

The following enhancement(s) are required to satisfy the NUREG-1801 aging management program recommendations. Details of the enhancements are included in the appropriate element descriptions below. Enhancements are scheduled for completion prior to the period of extended operation.

- Detection of Aging Effects

  The MNGP Fire Water System Program 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.

  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.

Verify the 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.

Aging Management Program Elements

The elements, which are part of the Fire Water System Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M27, Fire Water System, are also provided.

Scope of Program

The MNGP Fire Water System Program focuses on managing loss of material due to corrosion of carbon steel, cast-iron, stainless steel, and copper alloys in fire protection system components exposed to water. Hose stations and standpipes are considered as piping in this AMP.

The Fire Water System Program manages the aging effects for components of the following systems and structures:

Fire

Preventive Actions

The Fire Water System is subjected to flushing and performance testing on scheduled periodic intervals. Piping inspections to detect pipe wall thinning and internal blockage are conducted as part of this program.

Parameters Monitored or Inspected

Design features provide direct and indirect indication of the system's ability to maintain firewater pressure. Internal system corrosion is monitored via proceduralized inspection activities. The underground fire main is flushed and the fire pumps flow tested at scheduled periodic intervals to assure system capability. Wall thickness examinations are performed to ensure that the system maintains its intended function.

Detection of Aging Effects

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 is similar to the conditions that exist above grade.

Enhancements to this element are:

- 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.
- 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.
- Verify the procedures to be used for aging management activities of License Renewal fire water systems apply testing in accordance with applicable NFPA codes and standards. Revise the relevant procedures as appropriate.

Monitoring and Trending

The Fire Water System pressure is continuously monitored. Fire pump performance and hence, system performance, is monitored via testing and trended as required by procedure. The pipe inspection program requires periodic re-inspection or augmented inspection of piping exhibiting degradation or blockage above established limits. An evaluation of pipe blockage or pipe wall thinning to assess operability and structural integrity of the piping system is an established element of the program.

Acceptance Criteria

Both direct and indirect means exist to continuously monitor system pressure. Piping inspections are part of a formal program. The objectives of the inspection program are to identify and determine the extent of potential piping degradation and to take appropriate action to maintain operability of fire water piping systems. The pipe inspection program establishes acceptance criteria for inspected piping, requirements for periodic re-inspection of piping and evaluation of degraded conditions to assure system operability. The program addresses the degradation to the sprinkler heads.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

The Fire Water System Program has been effective in managing aging effects due to corrosion and biofouling in the MNGP Fire Water Systems such that the Fire Water System has been able to perform its intended function. Through the use of established plant surveillances and procedures, the system is periodically inspected, tested, flushed, and maintained. 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 been good as demonstrated by only six cases of system impairment for more than 48 hours since October 1996, in order to perform required maintenance. System unavailability is within Maintenance Rule program goals.

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

Conclusion

Implementation of the MNGP Fire Water System Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.19 Flow-Accelerated Corrosion

Program Description

The Flow-Accelerated Corrosion Program manages aging effects (loss of material) due to flow-accelerated corrosion (FAC) on the internal surfaces of carbon or low alloy steel piping, elbows, reducers, expanders, and valve bodies 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; (c) follow-up inspections to confirm the predictions; and (d) repairing or replacing components, as necessary.

The MNGP Flow-Accelerated Corrosion Program includes the response made to GL 89-08, Erosion/Corrosion Induced Pipe Wall Thinning.

NUREG-1801 Consistency

The MNGP Flow-Accelerated Corrosion Program is an existing program. It is consistent with the recommendations of NUREG-1801 Chapter XI, Program XI.M17.

Exceptions to NUREG-1801

None.

Enhancements

None.

Aging Management Program Elements

The elements, which are part of the Flow-Accelerated Corrosion Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M17, Flow-Accelerated Corrosion are also provided.

Scope of Program

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

The Flow-Accelerated Corrosion Program manages the aging effects for susceptible components of the following systems and/or structures:

Chemistry Sampling	Reactor Head Vent
Condensate & Feedwater	Reactor Recirculation
High Pressure Coolant Injection	Reactor Water Cleanup
Main Steam	Turbine Generator
Reactor Core Isolation Cooling	

Preventive Actions

MNGP FAC Program is an analysis, inspection, and verification program; thus, there is no prevention action. However, MNGP does monitor water chemistry to control pH and dissolved oxygen, and FAC mitigation is to be considered for repair and replacement of components.

Parameters Monitored or Inspected

The Flow-Accelerated Corrosion Program monitors the effects of FAC on the intended function of piping and components by measuring wall thickness by NDE techniques.

Detection of Aging Effects

MNGP conducts an inspection program in accordance with NSAC-202L-R2. Ultrasonic and radiographic testing is used to detect wall thinning. The extent and frequency of inspections assure detection of wall thinning prior to the loss of intended function.

Monitoring and Trending

The MNGP FAC Program uses the CHECWORKS predictive code to predict component degradation for modeled systems. CHECWORKS is used to establish inspection scope and frequency to assure structural integrity of susceptible systems and components will be maintained between inspections. CHECWORKS is also used in assisting in wall thickness evaluations. If degradation is detected such that the wall thickness is less than the minimum predicted thickness, additional examinations are performed in adjacent areas to bound the thinning.

Acceptance Criteria

MNGP FAC Program inspection results are used as input to CHECWORKS for calculating the number of refueling or operating cycles remaining before the component reaches the minimum allowable wall thickness. Any component that falls below the acceptance criteria listed in site procedures requires an engineering analysis to determine if a repair or replacement is required prior to the next scheduled outage.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

The Flow-Accelerated Corrosion Program has been effective in managing aging effects. Wall thinning problems in single-phase systems have occurred throughout the industry in feedwater and condensate systems, and in two-phase piping in extraction steam lines and moisture separator reheater and feedwater heater drains. Application of the program at the MNGP has resulted in the identification and replacement of susceptible piping sections with materials more resistant to 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. For example, during a recent ultrasonic thickness survey of a torus cooling line wall thinning was identified. Though attributed to cavitation and not FAC, the piping and associated valve will be replaced.

Results of recent operating experience and a FAC Program assessment revealed no significant program deficiencies and support a conclusion that the

FAC program effectively manages FAC in high-energy carbon steel piping and components.

Conclusion

Implementation of the MNGP Flow-Accelerated Corrosion Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.20 Fuel Oil Chemistry

Program Description

The Monticello Nuclear Generating Plant (MNGP) 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.

NUREG-1801 Consistency

The MNGP Fuel Oil Chemistry Program is an existing program. It will be enhanced to be consistent, with certain exceptions, with the recommendations of NUREG-1801 Chapter XI, Program XI.M30.

Exceptions to NUREG-1801

For further details, see the following element discussion(s) on the exceptions to NUREG-1801 aging management program elements:

- Preventive Actions

  The MNGP Fuel Oil Chemistry Program does not currently use biocides, stabilizers, and corrosion inhibitors. NUREG-1801, Section XI.M30, states that the quality of diesel fuel oil is maintained by additions of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel fuel oil, and corrosion inhibitors to mitigate corrosion. MNGP diesel fuel oil is purchased to ASTM D 975 requirements that address stability and corrosion. Biocides, stabilizers, and corrosion inhibiting additives have not been used at MNGP. Based on operating history and diesel fuel oil management activities, the addition of biocides, biological stabilizers, and corrosion inhibitors into stored diesel fuel oil at MNGP is not necessary. This conclusion is based on inspection activities spanning 20 years indicating no significant corrosion or degradation. Diesel fuel oil quality and particulate contamination is checked monthly. Quarterly checks are performed to ASTM D 975 acceptance criteria.

- Parameters Monitored or Inspected

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

  NUREG-1801, Section XI.M30, recommends the use of ASTM Standards D 1796 and D 2709 to test for water and sediment in diesel fuel oils. MNGP uses only ASTM D 1796 for verification that water and sediment are within specified limits. This standard is applicable to the grade of diesel fuel oil used at MNGP.

  NUREG-1801, Section XI.M30, also recommends the use of a modified ASTM D 2276 for sampling of particulate contaminants. MNGP uses ASTM Standard D 6217 as a laboratory test to sample diesel fuel oil for suspended particulates. This standard is applicable to the grade of diesel fuel oil used at MNGP. This standard utilizes the more conservative filter pore size of 0.8 mm versus the recommended 3.0 mm.

- Acceptance Criteria

  ASTM D 2709 and ASTM D 2276 are not utilized at MNGP. NUREG-1801, Section XI.M30, recommends the use of ASTM Standards D 1796 and D 2709 to test for water and sediment in diesel fuel oils. MNGP uses only ASTM D 1796 for verification that water and sediment are within specified limits. This standard is applicable to the grade of diesel fuel oil used at MNGP.

  NUREG-1801, Section XI.M30, also recommends the use of a modified ASTM D 2276 for sampling of particulate contaminants. MNGP uses ASTM Standard D 6217 as a laboratory test to sample diesel fuel oil for suspended particulate. This standard is applicable to the grade of diesel fuel oil used at MNGP. This standard utilizes the more conservative filter pore size of 0.8 mm versus the recommended 3.0 mm.

Enhancements

The following enhancement(s) are required to satisfy the NUREG-1801 aging management program recommendations. Details of the enhancements are included in the appropriate element descriptions below. Enhancements are scheduled for completion prior to the period of extended operation.

- Scope of Program

  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.

- Preventive Actions

  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.

- Detection of Aging Effects

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

Aging Management Program Elements

The elements, which are part of the MNGP Fuel Oil Chemistry Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M30, Fuel Oil Chemistry are also provided.

Scope of Program

The scope of MNGP Fuel Oil Chemistry Program includes verification of the diesel fuel oil acceptability and verifying that unacceptable degradation is not occurring in the diesel fuel oil system components.

In addition, procedures will be enhanced to include requirements to check for general, pitting, crevice, galvanic, microbiological influenced corrosion (MIC), and cracking.

The MNGP Fuel Oil Chemistry Program manages the aging effects for components of the following systems and/or structures:

Emergency Diesel Generator

Preventive Actions

The MNGP Fuel Oil Chemistry Program provides assurance that the diesel fuel oil supply is of acceptable quality and that the system components are not degraded by the identified aging effect (loss of material and cracking) caused by various corrosion mechanisms. Diesel fuel oil inspection, sampling, and turnover, combined with tank cleaning and inspection, help to prevent diesel fuel oil and equipment degradation.

MNGP takes an exception to NUREG-1801, Section XI.M30, which states that the quality of diesel fuel oil is maintained by additions of biocides to minimize biological activity, stabilizers to prevent biological breakdown of the diesel oil, and corrosion inhibitors to mitigate corrosion. Biocides, stabilizers, and corrosion inhibiting additives are not used at MNGP. They are not needed based on operating history and because of MNGP's diesel fuel oil management activities. Diesel fuel oil viscosity and water and sediment are checked monthly as referenced by ASTM D 975. Quarterly checks of other diesel fuel oil characteristics (e.g., flash point, API gravity, cetane index) are performed to MNGP diesel fuel oil specifications.

In addition, procedures will be enhanced to require tank draining, cleaning and inspecting 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.

Parameters Monitored or Inspected

The MNGP Fuel Oil Chemistry Program monitors diesel fuel oil quality, including water and sediment volume, along with sampling for other contaminants. The Diesel Oil Storage Tank and the Emergency Diesel Generator Day Tanks are inspected for corrosion. Periodic NDE wall thickness measurements of the storage tank and the day tanks have been completed.

MNGP takes an exception to NUREG-1801, Section XI.M30, in that ASTM D 2709 and ASTM D 2276 are not utilized at MNGP.

NUREG-1801, Section XI.M30, recommends the use of ASTM D 1796 and ASTM D 2709 to test for water and sediment in diesel fuel oils. MNGP uses only ASTM D 1796 for verification that water and sediment are within specified limits. This standard is applicable to the grade of diesel fuel oil used at MNGP.

NUREG-1801, Section XI.M30, also recommends the use of a modified ASTM D 2276 for sampling of particulate contaminants. MNGP uses ASTM Standard D

6217 as a laboratory test to sample diesel fuel oil for suspended particulates. This standard is applicable to the grade of diesel fuel oil used at MNGP. This standard utilizes the more conservative filter pore size of 0.8 mm versus the recommended 3.0 mm.

The ASTM Standards used at MNGP, combined with the MNGP diesel fuel oil management activities, provide equivalent testing methods to those specified in NUREG-1801, Section XI.M30.

Detection of Aging Effects

The MNGP Fuel Oil Chemistry Program includes existing plant procedures that verify the acceptability of the diesel fuel oil by sampling for water, sediment, and other contaminants. The Diesel Oil Storage Tank and the EDG Day Tanks have been cleaned and inspected since plant startup and the EDG base tanks have been cleaned and flushed.

In addition, the procedures will be enhanced to require periodic tank inspections.

Monitoring and Trending

The MNGP Fuel Oil Chemistry Program monitors water and sediment in the diesel fuel oil system monthly. Various other diesel fuel oil parameters are analyzed and trended quarterly per MNGP procedures. The procedurally required monthly and quarterly diesel fuel oil sampling and analysis provide for timely detection of diesel fuel oil conditions that could lead to tank internal corrosion, cracking, or other diesel generator operational problems.

Acceptance Criteria

The MNGP Fuel Oil Chemistry Program uses acceptance criteria based upon various ASTM standards. MNGP's routine monthly and quarterly surveillance diesel fuel oil sampling requirements are based upon ASTM D 4057, Standard Practice for Manual Sampling of Petroleum and Petroleum Products, and are required to meet the limits for viscosity, water and sediment per the requirements specified in Table 1 of ASTM D 975, Standard Specification for Diesel Fuel Oils, and ASTM D 1796, Water and Sediment in fuel Oil by Centrifuge. In addition, MNGP's particulate contamination sampling is based on ASTM D 6217, Standard Test Method for Particulate Contamination in Middle Distillate Fuels by Laboratory Filtration.

MNGP takes an exception to NUREG-1801, Section XI.M30, in that ASTM D 2709 and ASTM D 2276 are not utilized at MNGP.

NUREG-1801, Section XI.M30, recommends the use of ASTM D 1796 and ASTM D 2709 to test for water and sediment in diesel fuel oils. MNGP uses only ASTM D 1796 for verification that water and sediment are within specified limits. This standard is applicable to the grade of diesel fuel oil used at MNGP.

NUREG-1801, Section XI.M30, also recommends the use of a modified ASTM D 2276 for sampling of particulate contaminants. MNGP uses ASTM Standard D 6217 as a laboratory test to sample diesel fuel oil for suspended particulates. This standard is applicable to the grade of diesel fuel oil used at MNGP. This standard utilizes the more conservative filter pore size of 0.8 mm versus the recommended 3.0 mm.

The ASTM Standards used at MNGP, combined with MNGP's diesel fuel oil management activities, provide equivalent testing methods to those specified in NUREG-1801, Section XI.M30.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

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

Conclusion

Implementation of the MNGP Fuel Oil Chemistry Program will provide reasonable assurance that aging effects will be managed such that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.21 Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements

Program Description

The MNGP Inaccessible Medium Voltage (2 kV to 34.5 kV) 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 purpose of this aging management program will be to demonstrate that inaccessible, non-EQ medium-voltage cables susceptible to aging effects caused by moisture and voltage stress will be adequately managed so that there is reasonable assurance that the cables will perform their intended function in accordance with the current licensing basis during the period of extended operation. 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.

NUREG-1801 Consistency

The MNGP Inaccessible Medium Voltage (2 kV to 34.5 kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program is a new program. It will be consistent with the recommendations of NUREG-1801 Chapter XI, Program XI.E3.

Exceptions to NUREG-1801

None.

Enhancements

None.

Aging Management Program Elements

The program elements, which are part of the Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program are described below. The results of an evaluation of each element against NUREG-1801, Generic Aging Lessons Learned (GALL) Report, Chapter XI, Program XI. E3, Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements is provided.

Scope of Program

This program applies to inaccessible (e.g., in conduit or direct buried) medium-voltage cables within the scope of license renewal that are exposed to significant moisture simultaneously with significant voltage. Significant moisture is defined as periodic exposures to moisture that last more than a few days (e.g., cable in standing water). Periodic exposures to moisture that last less than a few days (i.e., normal rain and drain) are not significant. Significant voltage exposure is defined as being subjected to system voltage for more than twenty-five percent of the time. The moisture and voltage exposures described as significant in these definitions, which are based on operating experience and engineering judgment, are not significant for medium-voltage cables that are designed for these conditions (e.g., continuous wetting and continuous energization is not significant for submarine cables).

The Inaccessible Medium Voltage (2kV to 34.5kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program manages the aging effects of medium voltage cables associated with systems identified as being within scope of license renewal and which are required to support an intended function of a component. MNGP treats cables as commodities and as such no system listing is provided.

Preventive Actions

Periodic actions are taken to prevent medium voltage cables not designed for submergence from being subject to prolonged exposure to significant moisture, such as inspecting for water collection in cable manholes and conduit, and draining water, as needed. Medium-voltage cables, for which such actions are taken, are not required to be tested since operating experience indicates that prolonged exposure to significant moisture and being energized for significant periods of time are required to induce this aging effect.

Parameters Monitored or Inspected

The MNGP program will test medium-voltage cables (2 kV 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% of the time. The testing conducted will provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to the initial test, and will be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2, or other testing that is state-of-the-art at the time the test is performed.

Detection of Aging Effects

The MNGP program will test inaccessible non-EQ medium-voltage cables (2 kV 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% of the time at least once every 10 years. As stated in NUREG-1801, this is an adequate period to preclude failures of the conductor insulation since experience has shown that aging degradation is a slow process. This testing frequency provides an indication of insulation condition and the ability of the cable to perform its intended function. The first tests for license renewal are to be completed before the period of extended operation.

Monitoring and Trending

Trending actions are not included as part of this program because the ability to trend specific test results is dependent on the specific type of test chosen and the environmental conditions during the test.

Acceptance Criteria

The acceptance criteria will be determined from the specific type of test performed and the specific cable tested.

Corrective Actions

A corrective action assessment will be performed when the test results, established for the cable being tested, are not within established test acceptance criteria. The test acceptance criteria will be established to ensure that the intended function of the electrical cable can be maintained consistent with the current licensing basis. The assessment will consider the significance of the test results, the operability of the component, the reportability of the event, the extent of the concern, the corrective actions required, and the likelihood of recurrence. When appropriate, root cause analysis will be performed in accordance with site corrective action procedures. When an unacceptable condition is identified, a determination is made as to whether the same condition is applicable to other inaccessible, in-scope, medium-voltage cables.

Also refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

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.

There is reasonable assurance that the program will adequately manage the various aging effects and that the cables tested by this program will continue to perform their intended functions for the period of extended operation. This program is a new plant specific program intended to manage identified aging effects through testing of cable within the license renewal scope. Since it is a new program, there is no existing OE that provides objective evidence that the program is effective at aging management.

Conclusion

Implementation of the MNGP Inaccessible Medium Voltage (2 kV to 34.5 kV) Cables Not Subject to 10 CFR 50.49 EQ Requirements Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation. The program will be implemented prior to the period of extended operation.

B2.1.22 Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems

Program Description

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 in-scope load handling components. Functional tests are also performed to assure their integrity. The cranes also comply with the maintenance rule requirements provided in 10 CFR 50.65.

NUREG-1801 Consistency

The Inspection of Overhead Heavy Load & Light Load (Related to Refueling) Handling Systems Program is an existing program. It will be enhanced to be consistent, with certain exceptions, with the recommendations of NUREG-1801, Chapter XI, Program XI.M23.

Exceptions to NUREG-1801

For further details, see the following element discussion(s) on the exceptions to NUREG-1801 aging management program elements:

- Parameters Monitored or Inspected

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

Enhancements

The following enhancement(s) are required to satisfy the NUREG-1801 aging management program recommendations. Details of the enhancements are included in the appropriate element descriptions below. Enhancements will be completed prior to the period of extended operation.

- Detection of Aging Effects

  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.

Aging Management Program Elements

The elements, which are part of the Inspection of Overhead Heavy Load & Light Load (Related to Refueling) Handling Systems Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M23, Inspection of Overhead Heavy Load & Light Load (Related to Refueling) Handling Systems, are also provided.

Scope of Program

Load handling equipment in scope for license renewal includes carbon steel components (loss of material due to general corrosion and wear; Cumulative fatigue damage due to fatigue), and aluminum components (loss of material due to crevice, galvanic, MIC and pitting corrosion; cracking due to stress corrosion cracking).

The Inspection of Overhead Heavy Load & Light Load (Related to Refueling) Handling Systems Program manages the aging effects for components of the following systems and structures:

Cranes, Heavy Loads, Rigging (Includes Reactor Component Handling Equipment)

Preventive Actions

The Inspection of Overhead Heavy Load & Light Load (Related To Refueling) Handling Systems Program activities include inspections to identify component-aging effects prior to loss of intended function. No preventive or mitigating attributes are associated with these activities.

Parameters Monitored or Inspected

Inspection activities as described in Detection of Aging Effects verify the structural integrity of in scope cranes, special lifting devices and load handling components in or above the spent fuel pool. These inspections also verify the effectiveness of maintenance and the effects of past and future usage on the structural reliability of the components. NUREG-1801 states that the number and magnitude of lifts made by the crane are reviewed. Except for special lifts made by the Turbine Building crane, the MNGP program does not provide for tracking the number and magnitude of lifts because administrative controls are implemented to ensure that only allowable loads are handled and fatigue failure of structural elements is not expected due to a limited number of lifts. In addition, qualified crane inspectors perform crane inspections and functional checks periodically. Crane operating procedures require crane inspections prior to each use. A time-limited aging analysis concludes that there are no fatigue concerns for the Reactor Building crane during the period of extended operation.

Detection of Aging Effects

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

Monitoring and Trending

There is no monitoring and trending requirements associated with the Inspection of Overhead Heavy Load & Light Load (Related To Refueling) Handling Systems Program.

Acceptance Criteria

Any significant visual indication of loss of material due to corrosion of structural members or rail wear is evaluated according to vendor recommendations and/or applicable industry good practice and standards. The Reactor Building and Turbine Building cranes were designed to Electric Overhead Crane Institute (EOCI), EOCI-61. In addition, procedures used for inspection, testing and maintenance of overhead handling devices comply with ANSI B30.2.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

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

Conclusion

Implementation of the MNGP Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.23 One-Time Inspection

Program Description

The MNGP One-Time Inspection Program will be implemented as a new program consistent with the recommendations of NUREG-1801 Chapter XI, Program M32, “One-Time Inspection.” This program will include measures to verify the effectiveness of the following aging management programs:

- Plant Chemistry Program
- Fuel Oil Chemistry Program

This program will also confirm the absence of age degradation in selected components (e.g., flow restrictors, venturis, and small bore piping) within License Renewal scope.

The MNGP One-Time Inspection Program addresses concerns and confirmation for the potential long incubation period for certain aging effects on structures and components. There are cases where either (a) an aging effect is not expected to occur but there is insufficient data to completely rule it out, or (b) an aging effect is expected to progress very slowly.

The activities of the One-Time Inspection Program include (a) determination of the sample size based on an assessment of materials of fabrication, environment, plausible aging effects, and operating experience; (b) identification of the inspection locations in the system or component based on the aging effect; (c) determination of the examination technique, including acceptance criteria that would be effective in managing the aging effect for which the component is examined; and (d) evaluation of the need for follow-up examinations to monitor the progression of any identified aging degradation.

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

NUREG-1801 Consistency

The MNGP One-Time Inspection Program is a new program. It will be consistent with the recommendations of NUREG-1801 Chapter XI, Program XI.M32, One Time Inspection.

Exceptions to NUREG-1801

None.

Enhancements

None.

Aging Management Program Elements

The elements, which are part of the MNGP One-Time Inspection Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI. M32, “One-Time Inspection,” are also provided.

Scope of Program

The scope of the MNGP One-Time Inspection Program includes validating the effectiveness of existing aging management programs (AMPs) by verifying that unacceptable degradation is not occurring in selected components, systems, and structures and confirming that management of aging-related degradation is not required.

The MNGP One-Time Inspection Program verifies the effectiveness of:

- The Plant Chemistry Program for managing the effects of aging in stagnant or low-flow portions of piping, or occluded areas of components, exposed to a treated water environment.
- The effectiveness of fuel oil chemistry control for managing the effects of aging of various components in systems that contain fuel oil.

The program will manage the aging effects due to corrosion, cracking, erosion, fouling, fretting, or thermal exposure. In addition, other license renewal components such as small bore piping will be inspected for age related degradation. This program will also verify the absence of reduction of neutron absorption capacity of boral in the spent fuel pool.

The One-Time Inspection Program manages the aging effects for components of the following systems and structures:

Automatic Pressure Relief	Main Steam
Chemistry Sampling	Primary Containment Mechanical
Combustible Gas Control	Radwaste Solid & Liquid
Condensate and Feedwater	Reactor Building
Condensate Storage	Reactor Building Closed Cooling Water
Control Rod Drive	Reactor Core Isolation Cooling
Core Spray	Reactor Head Vent
Demineralized Water System	Reactor Recirculation
Emergency Diesel Generators	Reactor Vessel Instrumentation
Emergency Filtration Train	Reactor Water Cleanup
Emergency Service Water	Residual Heat Removal
Fuel Pool Cooling and Cleanup	Secondary Containment
Heating & Ventilation	Standby Liquid Control
High Pressure Coolant Injection	Turbine Generator
Main Condenser	Wells and Domestic Water

Preventive Actions

The MNGP One-Time Inspection Program is intended to verify that aging degradation is either not occurring or occurring at such a slow rate that the component or structure's intended function is not affected. By definition, the inspections are one-time, and therefore they do not include any methods to prevent or mitigate degradation.

Parameters Monitored or Inspected

The aging effects that are monitored/inspected by the MNGP One-Time Inspection Program are crack initiation and growth, loss of material, heat transfer degradation, reduction of neutron absorption capacity, and change in material properties. This program includes one-time inspections to monitor a structure or component's degradation using a variety of non-destructive examination (NDE) methods, including visual, volumetric, and surface techniques.

Detection of Aging Effects

The detection of aging effects by the MNGP One-Time Inspection Program will ensure that any degradation will be discovered and repaired before the loss of an intended function. The program will develop guidance for population sampling, inspection locations and inspection methods.

The inspection criteria will include a representative sample of the system population, and, where practical, focus on the bounding or lead components most susceptible to aging due to time in service, material of construction, severity of operating conditions, environments, and operating experience. For small bore piping, actual inspection locations are based on physical accessibility, exposure levels, and non-destructive examination (NDE) techniques.

The inspection schedule and inspection methods will minimize the impact on plant operations. The NDE inspection methods that will be used, such as visual (or remote visual), surface or volumetric, or other established techniques, are consistent with industry practice. The inspections will be scheduled as close to the end of the current operating license as practical with margin provided to ensure completion prior to commencing the period of extended operation.

Monitoring and Trending

The MNGP One-Time Inspection Program will perform a one-time inspection prior to the end of the current licensing period to determine whether a structure/component will perform its intended function for the period of extended operation based on its condition at the time of inspection. Any degradation encountered will be evaluated, corrected and, if required, monitored or trended in accordance with the Corrective Action Program.

Acceptance Criteria

The MNGP One-Time Inspection Program will use the Corrective Action Program to evaluate indications or relevant conditions of degradation. The need to increase the number of selected components for inspection will also be evaluated when indications or relevant conditions of degradation or unacceptable conditions are found.

The ultrasonic thickness measurements are to be compared to predetermined limits, such as design minimum wall thickness.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

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

Conclusion

Implementation of the MNGP One-Time Inspection Program will provide reasonable assurance that aging effects will be managed so that the systems, structures, and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation. This program will be implemented prior to the period of extended operation.

B2.1.24 Open-Cycle Cooling Water System

Program Description

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.

NUREG-1801 Consistency

The MNGP Open-Cycle Cooling Water System Program is an existing program. It is consistent with the recommendations of NUREG-1801 Chapter XI, Program XI.M20, Open-Cycle Cooling Water System.

Exceptions to NUREG-1801

None.

Enhancements

None.

Aging Management Program Elements

The elements, which are part of the MNGP Open-Cycle Cooling Water System Program are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M20, “Open-Cycle Cooling Water System”, are also provided.

Scope of Program

MNGP's Open-Cycle Cooling Water System Program currently is contained in three plant programs involving both piping and heat exchanger activities. The Service Water and Fire Protection Inspection Program monitors aging effects applicable to piping. The Generic Letter 89-13 Program focuses on ensuring that safety related heat exchangers operate efficiently and reliably. It addresses cooling system problems and monitors corrosion and various fouling mechanisms. The Heat Exchanger Condition Assessment Program establishes a program for selection, inspection, assessment, and maintenance of plant heat exchangers.

The MNGP Open-Cycle Cooling Water System manages the aging effects for targeted components of the following systems and/or structures:.

Circulating Water	Heating & Ventilation
Core Spray System	Residual Heat Removal
Emergency Diesel Generators	Reactor Building Closed Cooling Water
Emergency Filtration Train	Service and Seal Water
Emergency Service Water	Turbine Generator

Preventive Actions

The MNGP Open Cycle Cooling Water (OCCW) systems are constructed of appropriate materials and are not lined or coated. The MNGP OCCW piping is primarily carbon steel. MNGP has a prevention and inspection monitoring program for OCCW piping and components that is based on NRC GL 89-13.

Control or preventive measures include biocide injection, silt dispersant injection, and system flushing.

Parameters Monitored or Inspected

The MNGP Open Cycle Cooling Water System Program includes inspection, monitoring, and testing of system piping, heat exchangers, and other components to counter the adverse effects due to biofouling, corrosion, and erosion. The cleanliness and material integrity are periodically inspected, monitored, or tested to ensure heat transfer capabilities. The program ensures adequate heat transfer capabilities by using NRC GL 89-13 guidance as the basis for service water related systems and components.

Detection of Aging Effects

The MNGP Open Cycle Cooling Water Program includes inspections for loss of material and heat transfer degradation due to biofouling, corrosion, and erosion. Inspection methods include both visual examinations and ultrasonic testing. Other nondestructive testing methods such as eddy current testing and heat transfer capability testing are performed. These methods measure surface condition and the extent of wall thinning associated with the OCCW service water system piping and components. Test results are used to determine corrosion rates, the extent of the biofouling or wall thinning.

Monitoring and Trending

The MNGP Open Cycle Cooling Water Program follows the guidance of NRC GL 89-13. Inspection scope, method (e.g., visual or nondestructive examination), and testing frequencies are in accordance with MNGP's commitments under NRC GL 89-13. The program directs testing and inspections, to be performed annually and during refueling outages, for system or component performance degradation. Heat transfer testing results are documented and trended by the system or program engineers.

Acceptance Criteria

The MNGP Open Cycle Cooling Water Program manages system or component aging effects via inspections, monitoring, and testing. Acceptance criteria are established for the assigned management activity, such as cleanliness, chemical treatment, erosion limits, and performance characteristics. NDE inspection techniques contain acceptance criteria and are used to determine the adequacy of the piping or heat exchangers.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

The MNGP Open-Cycle Cooling Water System Program has been effective in managing loss of material and heat transfer degradation aging effects for systems within the scope of the program. Program effectiveness has been demonstrated by various self-assessments and Nuclear Oversight Department reviews. These assessments have shown that the MNGP has implemented the requirements of GL 89-13. Corrosion and material condition issues have been documented and evaluated in the site Corrective Action Program. Corrective actions have been effective in addressing corrosion and other material condition issues of piping and components. Thus, there is reasonable assurance that the OCCW Program manages aging effects so that the systems, structures, and components within the program scope will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

Conclusion

Implementation of the MNGP Open Cycle Cooling Water Program will provide reasonable assurance that the aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.25 Plant Chemistry Program

Program Description

The MNGP Plant Chemistry Program mitigates the aging effects on component surfaces that are exposed to water as the process fluid; chemistry programs are used to control water chemistry for impurities (e.g., chloride and sulfate) that accelerate corrosion or crack initiation and growth and that cause heat transfer degradation due to fouling in select heat exchangers. This program relies on monitoring and control of water chemistry to keep peak levels of various contaminants below system-specific limits based on BWRVIP-130 (EPRI TR-1008192): BWR Water Chemistry Guidelines - 2004 Revision. BWRVIP-130 supersedes previous revisions of the BWR Water Chemistry Guidelines, including BWRVIP-29 (TR-103515, 1993 Revision).

For low-flow or stagnant portions of a system, a one-time inspection of selected components at susceptible locations provides verification of the effectiveness of the Plant Chemistry Program.

NUREG-1801 Consistency

The Plant Chemistry Program is an existing program. With exceptions, it is consistent with the recommendations of NUREG-1801, Chapter XI, Program M2, “Water Chemistry.”

Exceptions to NUREG-1801

For further details on exceptions to NUREG-1801 aging management program elements, see the specific element discussion(s) for this program:

- Scope of Program

  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).

  In the “Safety Evaluation Report Related to the License Renewal of Peach Bottom Atomic Power Station, Units 2 and 3" (NUREG-1769, Accession Number ML030300673), 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.

- Parameters Monitored/Inspected

  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.

Enhancements

None.

Aging Management Program Elements

The elements, which are part of the Plant Chemistry Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M2, “Water Chemistry”, are also provided.

Scope of Program

The purpose of the MNGP Plant Chemistry Program is to periodically monitor water chemistry and control known detrimental contaminants (such as chlorides, sulfates, and dissolved oxygen) to levels below those known to result in loss of material or crack initiation and growth in License Renewal Systems. The program includes water used in the reactor (primary), feedwater, condensate, control rod drive (CRD) and auxiliary systems as described in EPRI TR-1008192. Water chemistry control is performed in accordance with the guidelines of EPRI TR-1008192, the MNGP Technical Specifications, and plant and industry experience and implemented through plant procedures.

The program mitigates aging effects by controlling the chemical environment of systems and components. The program is credited for managing the component aging effects of loss of material (caused by general, crevice, galvanic, microbiologically influenced, and pitting corrosion), crack growth and initiation (caused by stress corrosion cracking/intergranular stress corrosion cracking - IGSCC), and heat transfer degradation (caused by heat exchanger fouling). For loss of material due to galvanic corrosion, the program actively monitors and controls water conductivity, which acts to minimize the rate of galvanic corrosion.

There is one exception to this program element. Specifically, 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), BWR Water Chemistry Guidelines - 2004 Revision, which replaced BWRVIP-79 (TR-103515-R2), BWR Water Chemistry Guidelines - 2000 Revision), incorporates updated industry experience, with increased focus on fuel performance concerns, while retaining the chemistry parameters, Action Levels, and associated measurement frequencies essentially unchanged.

In the "Safety Evaluation Report Related to the License Renewal of Peach Bottom Atomic Power Station, Units 2 and 3" (NUREG-1769, Accession Number ML030300673), the NRC found the provisions of BWRVIP-79 (TR-103515-R2), BWR Water Chemistry Guidelines - 2000 Revision, acceptable because the program is based on updated industry experience. BWRVIP-130 (TR-1008192) is the current update of the BWR Water Chemistry Guidelines and supersedes BWRVIP-79 (TR-103515-R2).

The Plant Chemistry Program manages the aging effects for components of the following systems and/or structures:

Automatic Pressure Relief	Reactor Building (spent fuel pool)
Chemistry Sampling	Primary Containment Mechanical
Combustible Gas Control	Reactor Head Vent
Condensate and Feedwater	Reactor Pressure Vessel Internals
Condensate Storage	Reactor Pressure Vessel
Control Rod Drive	Reactor Vessel Instrumentation
Core Spray	Residual Heat Removal

Demineralized Water	Reactor Core Isolation Cooling
Fuel Pool Cooling & Cleanup	Reactor Recirculation
High Pressure Coolant Injection	Reactor Water Cleanup
Main Condenser	Standby Liquid Control
Main Steam	Turbine Generator
Primary Containment	

Preventive Actions

The MNGP Plant Chemistry Program includes specifications for chemical species, sampling and analysis frequencies, and acceptance limits. Corrective actions are required for chemistry conditions that do not meet acceptance limits consistent with the Action Levels and recommendations of EPRI TR-1008192 for reactor, feedwater, condensate, control rod drive, and auxiliary water systems. These guidelines are contained in chemistry procedures.

Implementation of these monitoring requirements for the chemical species and action levels, as described in EPRI TR-1008192, have been shown to be effective in mitigating aging effects.

Parameters Monitored or Inspected

The MNGP Plant Chemistry Program monitors and controls known detrimental contaminants in accordance with the limits of TR-1008192 for all modes of plant operation. With the exception of hydrogen peroxide, this includes chlorides, sulfates, dissolved oxygen, zinc, conductivity, and other parameters. Sampled water sources and frequencies are consistent with those identified in EPRI TR-1008192, including auxiliary systems. If reactor water conductivity readings become elevated, pH may also be periodically monitored to provide additional insights as to the cause of the transient. Requirements for equipment operation, how to obtain a representative sample, how to preserve samples, and how to confirm accurate and reliable results are obtained are established by plant procedures to ensure sample integrity is maintained.

There is one exception to this program element. Specifically, hydrogen peroxide levels are not measured as part of determining electrochemical potential (ECP). Instead, the MNGP Plant Chemistry Program utilizes Hydrogen Water Chemistry (HWC) and maintains chloride and sulfate levels in the reactor coolant as low as possible to achieve mitigation. Mitigation is defined as ECP less than negative 230mV (Standard Hydrogen Electrode, SHE), as determined by site specific radiolysis modeling, and is based on guidance contained in TR-1008192. Secondary parameters monitored include all those identified for a Category 2 HWC Plant in Table 2-6 of EPRI TR-1008192 for estimating ECP. As noted in EPRI TR-1008192, reliable measurements of hydrogen peroxide are exceptionally difficult to obtain and concentration can be estimated from radiolysis models.

Detection of Aging Effects

Aging effects are managed by controlling concentrations of known detrimental chemical species, such as dissolved oxygen, below the levels known to cause degradation (i.e., to minimize the corrosion of surfaces exposed to different water sources). As such, this is a mitigation program and does not provide for detection of the aging effects it is established to mitigate, i.e., loss of material, crack initiation and growth, and heat transfer degradation. The program is generally effective in intermediate and high flow areas but includes reliance on the MNGP One-Time Inspection Program for select low flow or stagnant areas to verify the effectiveness of the Plant Chemistry Program. In addition to the One-Time Inspection Program, Monticello relies on the ASME Section XI In-service Inspection, Subsections IWB, IWC, and IWD Program for pressure-retaining system and component inspections as another method to verify the effectiveness of the MNGP Plant Chemistry Program.

Monitoring and Trending

Guidelines for monitoring frequency are established consistent with Section 6 and Appendix B of EPRI TR-1008192. These frequencies may vary based on plant operating conditions or established trends.

When limits are not met, corrective actions are initiated to correct the condition. Corrective actions are initiated through the issuance of an Action Request in the MNGP Corrective Action Program. Follow-up sampling and analysis actions are performed when required as part of evaluating corrective action effectiveness.

The MNGP Chemistry Department maintains a Chemistry Performance Indicator (CPI) to monitor operational chemistry control effectiveness. The chemistry indicator combines several key chemistry parameters into a single indicator that provides an overview of the relative effectiveness of plant operational chemistry control. The indicator is measured daily and reported on a routine basis. Additionally, sample analysis results are documented in a manner that facilitates the identification of adverse trends. Procedural requirements are established on how to evaluate sample results for adverse trends and to initiate Action Requests for entry into the Corrective Action Program.

Acceptance Criteria

The Monticello Plant Chemistry Program includes maximum contaminant levels based on the EPRI 2004 BWR Water Chemistry Guidelines (TR-1008192). Select limits are also contained in specific plant operating procedures that must be met prior to startup.

When limits are not met, chemistry procedures require the initiation of corrective actions to correct the condition. Corrective actions are initiated through the issuance of an Action Request in the MNGP Corrective Action Program. Depending on the significance of the issue, root cause analysis may be required.

Chemistry effectiveness is monitored through the One-Time Inspection and ASME Section XI In-service Inspection Programs. Evidence of aging effects would be properly documented and further evaluated for the cause and required corrective action(s), including consideration of known detrimental contaminants.

Corrective Actions

Chemistry parameters, limits, Action Levels, required actions to be taken, and time period in which they are to be completed are defined in plant procedures. These requirements are consistent with Section 6 and Appendix B of EPRI TR-1008192. The EPRI Action Levels are included in the MNGP Corrective Action Program as one of the screening criterion used to assign issue significance. The highest EPRI Action Level corresponds to the highest level of assigned issue significance. Conditions that result in the achievement of an Action Level are entered into the Corrective Action Program for evaluation and resolution. Consistent with the EPRI definitions, these issues can result in plant shutdown depending on the nature and cause of the chemical parameter(s) being out of limit. The Corrective Action Program meets the requirements of 10 CFR 50, Appendix B, for addressing corrective actions.

Also refer to Section B1.3.

Confirmation Process

Corrective action effectiveness is part of the MNGP Corrective Action Program. Follow-up sampling and analysis actions are performed as part of evaluating corrective action effectiveness as established by the Corrective Action Program.

Also refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

The MNGP Plant Chemistry Program has been effective in monitoring and controlling water chemistry and in performing its function in mitigating aging effects. Based on a review of condition reports/action requests, the plant has taken timely and effective corrective action when limits were not met to resolve abnormal conditions. Condition reports/action requests are initiated when water chemistry is found to be out of specification. Many of these conditions are the result of equipment or plant transient conditions (e.g., plant startup) that are resolved once the transient condition subsides. The time duration of these conditions is typically short and no evidence of detrimental equipment impacts could be found. Further, no examples of component functional failures due to corrosion, cracking, or heat transfer degradation resulting from inadequate chemistry control were identified.

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.

Conclusion

Implementation of the MNGP Plant Chemistry Program will provide reasonable assurance that aging effects will be managed so that the systems, structures, and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis for the period of extended operation.

B2.1.26 Primary Containment In-Service Inspection Program

Program Description

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 program conforms to the applicable requirements of 10CFR50.55a and the 1992 Edition with 1992 Addenda of the ASME Boiler and Pressure Vessel Code, Subsection IWE.

A detailed VT-3 and VT-1 examination is performed once during each 10-year 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 CFR50.55a.

NUREG-1801 Consistency

The Primary Containment In-Service Inspection Program is an existing program. It is consistent with NUREG-1801, Chapter XI, Program XI.S01and ASME Section XI, Subsection IWE.

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.

Exceptions to NUREG-1801

None.

Enhancements

None.

Aging Management Program Elements

The elements, which are part of the Primary Containment In-Service Inspection Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.S1 and ASME Section XI, Subsection IWE, are also provided.

Scope of Program

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.

In order to perform inspections of the torus internal components, special procedures are required. Since these requirements are met when the primary containment inspections are performed, steel components located within the torus are inspected as part of the Primary Containment In-Service Inspection Program.

Surface and / or volumetric examination may be done to augment visual examination as necessary 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 Primary Containment In-Service Inspection Program consists of activities that manage the aging effects for: carbon steel; stainless steel bellows; dissimilar metal welds; Nickel alloy bellows; doors; bolted closures; seals; gaskets and moisture barriers.

10CFR50.55a states that the VT-1 and surface examinations of pressure retaining welds specified in Sub-Section IWE are optional; the MNGP program includes these welds within the scope of the VT-3 and General Visual examinations. The current MNGP program does not require the examination of seals & gaskets, the measurement of residual bolt torque, the pre-service examination of new coatings or the pre-removal examination of existing coatings. 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.

The Primary Containment In-Service Inspection Program manages the aging effects for components of the following systems and structures:

Hangers and Supports	Primary Containment

Preventive Actions

The Primary Containment In-Service Inspection Program is a monitoring program. The program does not specify preventive actions.

Parameters Monitored or Inspected

The MNGP Primary Containment In-Service 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 (post-accident retention of radioactive materials and pressure suppression) of the containment system. It also specifies visual examination of the moisture barrier between the drywell shell and the interior slab to detect loss of sealing function.

Examinations of metallic surfaces monitor corrosion, cracking, mechanical damage, discoloration and other phenomena that can potentially impact structural and / or leak tight integrity. Most examination surfaces are coated; therefore, examinations focus on coating conditions that indicate the possible deterioration of the underlying metal.

The program requires thickness and other measurements if these are determined necessary to assess the significance of observed surface conditions.

The moisture barrier sealing the interface between the drywell shell and interior slab is examined for signs of damage, deterioration, loss of bond and other conditions that could result in water penetration.

The MNGP program doesn't include residual bolt torque measurement and penetration seal / gasket examination. 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.

Detection of Aging Effects

The MNGP Primary Containment In-Service Inspection Program specifies visual examination of accessible surface areas as the primary tool for detecting aging effects. Visual examinations conform to the requirements of Sub-Section IWE and referenced paragraphs of Sub-Section IWA except that direct examination distances and lighting may be determined by resolution requirements as allowed by 10CFR50.55a(b)(2)(ix)(B).

Surface or volumetric NDE may be required to evaluate the extent of damage or deterioration found by visual examination. Also, augmented (more frequent and / or more detailed) examination may be required to ensure effective detection of aging effects in such damaged or deteriorated areas. The need for NDE and augmented examination is determined by evaluation of visual examination findings.

Reasonable confidence that developing aging effects will be detected is assured by the program mandate that 100% of all required examinations be completed within each successive 10-year primary containment ISI interval. Within intervals, examinations are done as specified in Table IWE-2500-1, except as noted below.

The program requires a General Visual examination of all accessible surfaces, except submerged surfaces, once during each period. It requires a VT-3 visual examination of all accessible surfaces, including submerged surfaces, once during each interval. Sub-Section IWE requires the VT-3 examination to be done at the end of the interval. The MNGP program allows a part of this exam to be done during each period. 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.

To provide reasonable assurance that aging effects in bolting are detected before these compromise containment integrity, the program requires a VT-1 examination of all exposed bolting surfaces during each interval and, in addition, an examination of all bolting items when a bolted connection is disassembled.

Monitoring and Trending

MNGP monitors primary containment integrity by performing visual examinations at regular intervals to detect damage, deterioration and other aging effects. Aging effects that do not meet acceptance criteria are evaluated and either repaired, or trended to determine long term impact on containment integrity. Monitoring to provide trend information follows an augmented examination program that is based on engineering evaluation, as allowed in 10CFR50.55a(b)(2)(ix)(D), rather than on the prescriptive requirements of Sub-Section IWE. The augmented examination program includes thickness measurements if the aging effect requiring trending is at a location that is accessible for examination from only one side.

The MNGP Program allows the need for augmented examination of repaired areas to be based on engineering evaluation rather than on the prescriptive requirements of Sub-Section IWE. 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.

Acceptance Criteria

MNGP incorporates the acceptance standards of Subsection IWE. Observed indications of damage, deterioration or other aging effects are evaluated. Evaluations must state that observed indications are acceptable with no further action required, provisionally acceptable with augmented monitoring and trending required or unacceptable, in which case repair is required.

Augmented monitoring must include thickness measurements if the affected area is accessible from only one side. If thickness measurements indicate an actual or projected (to the time of the next scheduled measurement) material loss in excess of 10% of the nominal wall thickness, the condition must be evaluated for acceptability.

Corrective Actions

Per plant administrative procedures, repairs/replacements and re-examinations comply with IWA-4000. The MNGP Program for the 4th 10 year In-service Inspection Interval allows the 2001 Edition of Section XI to be used for IWA-4000. 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.

Also refer to Section B1.3.

Confirmation Process

Per plant administrative procedures, repairs/replacements and re-examinations comply with IWA-4000. The MNGP Program for the 4th 10 year In-service Inspection Interval allows the 2001 Edition of Section XI to be used for IWA-4000. 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.

Also refer to Section B1.3.

Administrative Controls

Per administrative procedures, the records required per IWA-6000 are prepared and retained.

Also refer to Section B1.3.

Operating Experience

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. 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.

Considering plant experience in implementing the Primary Containment In-Service Inspection Program, it may be concluded that this program, when complemented by the 10 CFR 50, Appendix J Program, will provide reasonable assurance that primary containment, internal vent system and steel components within the torus aging effects are effectively managed throughout the period of extended operation.

Conclusion

Implementation of the MNGP Primary Containment In-Service Inspection Program (ASME Section XI, Subsection IWE) will provide reasonable assurance that aging effects will be managed so that the structures and structural components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.27 Protective Coating Monitoring & Maintenance Program

Program Description

The MNGP Protective Coating Monitoring and Maintenance Program applies to Service Level 1 protective coatings inside containment to address the concerns of NRC GL 98-04, Potential for Degradation of the Emergency Core Cooling System and the Containment Spray System after a Loss-of-Cooling Accident because of Construction and Protective Coating Deficiencies and Foreign Material in Containment. The Protective Coating Monitoring and Maintenance Program prevents the degradation of coatings that could lead to the clogging of ECCS suppression pool suction strainers. MNGP does not credit the Protective Coating Monitoring and Maintenance Program for the prevention of corrosion of carbon steel components.

As outlined in MNGP's response to GL 98-04, the Protective Coating Monitoring and Maintenance Program is a comparable program for monitoring and maintaining protective coatings inside the primary containment and subject to the requirements of ANSI N101.4-1972, to the extent specified in ANSI N18.7-1976 and as modified by Regulatory Guide 1.54, June 1973.

NUREG-1801 Consistency

The MNGP Protective Coating Monitoring & Maintenance Program is an existing program. It will be enhanced to be consistent with the recommendations of NUREG-1801, Chapter XI, Program XI.S8.

Exceptions to NUREG-1801

None.

Enhancements

The following enhancement(s) are required to satisfy the NUREG-1801 aging management program recommendations. Details of the enhancements are included in the appropriate element descriptions below. Enhancements will be completed prior to the period of extended operation.

- Scope of Program

  The MNGP Protective Coating Maintenance and Monitoring Program procedures will be updated to include inspection of all accessible painted surfaces inside containment.

- Monitoring and Trending

  The MNGP Protective Coating Maintenance and Monitoring Program will be revised to include a pre-inspection review of the previous two inspection reports so that trends can be identified.

- Acceptance Criteria

  The MNGP Protective Coating Maintenance and Monitoring Program implementation procedures will be revised to include provisions for analysis of suspected reasons for coating failure.

Aging Management Program Elements

The elements, which are part of the MNGP Protective Coating Maintenance and Monitoring Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.S8, “Protective Coating Monitoring and Maintenance Program,” are also provided.

Scope of Program

The MNGP Protective Coating Maintenance and Monitoring Program provides for inspections of the drywell and torus interior coated surfaces. The torus inspections include both above and below water surface inspections. The program will be enhanced to include all accessible interior coated surfaces.

The Program manages the aging effects for components of the following systems and structures:

Primary Containment

Preventive Actions

The Protective Coating Monitoring and Maintenance Program is not relied upon to manage loss of material due to corrosion of carbon steel. The Primary Containment In-Service Inspection, the System Condition Monitoring and Structures Monitoring Programs perform that function. The Protective Coating Monitoring and Maintenance Program is primarily relied upon to ensure that degradation of protective coatings inside containment won't lead to clogging of the ECCS suction strainers. However, proper maintenance of the protective coatings inside containment is a good method to prevent loss of material due to corrosion of carbon steel.

Parameters Monitored or Inspected

Inspection procedures specify that the coated surfaces be inspected for rust, flaking, peeling, blistering, cracking and checking.

Detection of Aging Effects

The Protective Coating Monitoring and Maintenance Program requires inspections to be performed each operating cycle for the torus above water line and drywell-coated surfaces. The below water line painted surfaces, including the areas near the ECCS suction strainers, are inspected at intervals not exceeding five years. Knowledgeable coatings personnel perform the inspections using appropriate equipment as necessary. A VT-3 exam is performed for all coatings degradation identified by the inspector. All unacceptable areas are required to be repaired or evaluated.

Monitoring and Trending

Currently, the MNGP Protective Coatings Monitoring and Maintenance Program provides no trending. Since all coated surfaces are inspected each time, all previously identified areas with coating degradation, whether repaired or un-repaired, are monitored for further degradation. The program will be enhanced to include a pre-inspection review of the previous two inspection reports so that trends can be identified.

Work orders are created to repair all areas noted as unacceptable. These repairs are performed during the same outage as the inspection, during the next outage or in the case of the torus, during the next torus draining.

Acceptance Criteria

The protective coatings inspection acceptance criteria are based on ASTM specifications D610, D660, D661, D662, D714, D772, D821 and D913. The procedures also indicate that if unacceptable surface areas are identified, then a Section XI, VT-3 examination is performed. If the VT-3 examination identifies unacceptable surface areas, then the area is to be repaired using the work order process or an engineering evaluation per Section XI, IWE-3122.4, is performed. All repairs are done during the same outage as the inspection unless it is determined that the repairs can wait to the next outage or in the case of the torus, the next torus draining. Implementing procedures will be enhanced to include provisions for analysis of suspected reasons for coating failure.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

The Protective Coating Monitoring and Maintenance Program is not relied upon to manage loss of material due to corrosion of carbon steel structural elements. Therefore, only the operating experience concerned with degradation of coatings and their consequential clogging of the ECCS strainers is of importance.

Since there currently are no coating inspection requirements for all components inside containment, the only inspection experience to date is those inspections of the drywell and torus shells. Inspections of the drywell and torus shell have identified the following signs of paint degradation: chipping, rusting, peeling, blistering, cracking and other signs of degradation. All unacceptable coating degradation has been repaired or in the case of the torus is scheduled for repair during the next torus draining.

These inspections have detected and evaluated aging effects prior to loss of intended function of the ECCS suction strainers. Where applicable, repairs were made such that further degradation of the coatings, which may lead to clogging of the ECCS suction strainers, would be minimized.

As the existing inspection programs have been effective in correcting the minor coating issues identified to date (which have not impacted ECCS operation), there is reasonable assurance the enhanced inspection program will effectively manage the impact of coatings inside the containment in order to prevent adverse impact on ECCS suction strainer operation.

Conclusion

Implementation of the MNGP Protective Coating Monitoring and Maintenance Program will provide reasonable assurance that aging effects will be managed so that the structures and structural components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.28 Reactor Head Closure Studs

Program Description

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 50.55.a.

NUREG-1801 Consistency

The Reactor Head Closure Studs Program is an existing program. It is consistent with the recommendations of NUREG-1801, Chapter XI, Program XI.M3, “Reactor Head Closure Studs.” 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.

Exceptions to NUREG-1801

None.

Enhancements

None.

Aging Management Program Elements

The program elements, which are part of the MNGP Reactor Head Closure Studs Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M3, “Reactor Head Closure Studs,” are also provided.

Scope of Program

The scope of the MNGP Reactor Head Closure Studs Program is part of the MNGP ASME Section XI In-Service Inspection Program and provides for condition monitoring of the reactor head studs, nuts, threads in flange, closure washers, and bushings in accordance with ASME Section XI, Table IWB-2500-1, Examination Category B-G-1.

Preventative measures to mitigate cracking have been taken in accordance with Regulatory Guide 1.65.

The Reactor Head Closure Studs Program manages the aging effects for components of the following systems and structures:

Reactor Pressure Vessel

Preventive Actions

The MNGP Reactor Head Closure Studs Program is a condition monitoring program that detects degradation of components before loss of intended function. Preventative measures to mitigate cracking have been taken in accordance with Regulatory Guide 1.65. The material for the closure studs and nuts is SA540, Grade B23/24. The reactor head studs at Monticello are not metal plated and have had a manganese phosphate coating applied.

Parameters Monitored or Inspected

The aging effect parameters that are monitored/inspected with the MNGP Reactor Head Closure Studs Program are crack initiation and growth. The Reactor Head Closure Studs Program is a condition monitoring program that detects and sizes flaws and defects by implementing the examination and inspection requirements of ASME Section XI as specified in Table IWB-2500-1.

Detection of Aging Effects

The detection of aging effects is prescribed by the MNGP Reactor Head Closure Studs Program in accordance with the requirements of ASME Section XI to ensure that aging effects will be discovered and repaired before the loss of intended function. The nondestructive detection techniques used include volumetric, surface, and visual examination methods to determine the general mechanical and structural condition of the reactor head closure stud bolting. The extent and schedule of the examinations are rigorously identified within the program.

Monitoring and Trending

The MNGP Reactor Head Closure Studs Program prescribes the monitoring and trending of the reactor head closure stud bolting. The program requirements for inspection schedule, extent, frequency, sequence of examinations, re-examinations, and additional examinations are in accordance with ASME Section XI, Article IWB-2400 and IWB-2500-1. If defects are detected, the scope of examination is expanded per the requirements of IWB-2430.

Acceptance Criteria

The MNGP Reactor Head Closure Studs Program prescribes the acceptance criteria for the reactor head closure stud bolting. Indications and relevant conditions detected during examinations are evaluated in accordance with ASME Section XI Articles IWB-3000, for Class 1 in accordance with MNGP procedures.

When a flaw exceeds the applicable acceptance standards of IWB-3500, corrective action is initiated in accordance with applicable MNGP procedures.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

The Reactor Head Closure Studs program has been effective in managing the aging effects of RPV closure studs. Plant operating experience have been considered in the evaluation of stud performance thus demonstrating an effective program has been established. 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.

Conclusion

Implementation of the MNGP Reactor Head Closure Studs Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.29 Reactor Vessel Surveillance

Program Description

The MNGP Reactor Vessel Surveillance Program is part of the Boiling Water Reactor's 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 NUREG-1801.

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.

NUREG-1801 Consistency

The MNGP Reactor Vessel Surveillance Program is an existing program. It will be enhanced to be consistent with the recommendations of NUREG-1801, Chapter XI, Program XI.M31, "Reactor Vessel Surveillance."

Exceptions to NUREG-1801

None.

Enhancements

The following enhancement(s) are required to satisfy the NUREG-1801 aging management program recommendations. Details of the enhancements are included in the appropriate element descriptions below. Enhancements are scheduled for implementation prior to the period of extended operation.

- Scope of Program

  MNGP intends to use the Integrated Surveillance Program during the period of extended operation by implementing the requirements of BWRVIP-116, which is currently being reviewed by the NRC.

Aging Management Program Elements

The elements, which are part of the MNGP Reactor Vessel Surveillance Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M31, “Reactor Vessel Surveillance,” are also provided.

Scope of Program

The MNGP Reactor Vessel Surveillance Program is an NRC approved ISP program that monitors radiation embrittlement of the reactor vessel. MNGP is part of the BWRVIP 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 NUREG-1801.

This program will be enhanced by the MNGP plan to use the Integrated Surveillance Program during the period of extended operation by implementing the requirements of BWRVIP-116, which is currently being reviewed by the NRC.

The MNGP Reactor Vessel Surveillance Program manages the aging effects for components of the following systems and/or structures:

Reactor Pressure Vessel

Preventive Actions

The MNGP Reactor Vessel Surveillance Program is consistent with the BWRVIP ISP. The BWRVIP ISP monitors capsule test results from various member plants and does not prescribe any preventive actions for MNGP.

Parameters Monitored or Inspected

The MNGP Reactor Vessel Surveillance Program follows the BWRVIP ISP program and monitors radiation embrittlement. Various environmental and metallurgical parameters are monitored, including fluence and material chemistry.

Detection of Aging Effects

The MNGP Reactor Vessel Surveillance Program follows the BWRVIP ISP. The ISP includes testing to detect changes in RPV embrittlement. The ISP performs Charpy V-notch testing on test specimens to measure the applicable aging effect, loss of fracture toughness.

Monitoring and Trending

The MNGP Reactor Vessel Surveillance Program uses the BWRVIP ISP to monitor the effect of irradiation on the vessel. The irradiated material properties (Charpy test results) are compared to available unirradiated properties, and the resulting irradiation shift is measured. The shift is a measure of the effect of irradiation on material toughness for the plate and weld materials. The ISP data is not trended.

Acceptance Criteria

The MNGP Reactor Vessel Surveillance Program is consistent with the BWRVIP ISP. The ISP does not contain any acceptance criteria for MNGP, but monitors the test results from various plants.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

The Reactor Vessel Surveillance Program has been effective in gathering and evaluating vessel material aging effects due to neutron irradiation embrittlement. For example, 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. This provides reasonable assurance that aging effects resulting in reactor vessel loss of fracture toughness will continue to be evaluated through sampling, analysis, and test.

Conclusion

The MNGP Reactor Vessel Surveillance Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.30 Selective Leaching of Materials

Program Description

The MNGP Selective Leaching of Materials Program will be implemented as a new program consistent, with exceptions, to the recommendations of NUREG-1801 Chapter XI, Program M33, “Selective Leaching of Materials.” The program will be developed and implemented before the start of the period of extended operation. The program includes a one-time visual inspection and hardness measurement of selected components that are susceptible to selective leaching. In situations where hardness testing is not practical, a qualitative method by other NDE or metallurgical methods will be used to determine the presence and extent of selective leaching.

The program will determine if selective leaching is occurring for selected components. Any required instructions or procedures will be written during development of the program. Existing MNGP procedures or work instructions may be used.

NUREG-1801 Consistency

The MNGP Selective Leaching of Materials Program is a new program. With exceptions, it will be consistent with the recommendations of NUREG-1801 Chapter XI, Program XI.M33.

Exceptions to NUREG-1801

Exceptions are taken to NUREG-1801 recommendations for hardness testing. For further details, see the following element discussion(s) on the exceptions to NUREG-1801 aging management program elements:

- Detection of Aging Effects

  Determination of selective leaching will typically be done by a one-time visual inspection and hardness measurement for components within the scope of this program. The following exceptions are taken to the NUREG-1801 Program:

  1) Hardness testing, other than Brinell hardness testing, may be used at the MNGP to identify the presence of selective leaching of material.

  This exception is justified because there are other acceptable hardness tests, besides Brinell, that can provide equivalent testing results for components within the scope of this program.

  2) Qualitative methods will be used at the MNGP in lieu of hardness testing to determine if selective leaching has occurred in situations where hardness testing is not practical.

  This exception is justified because hardness testing may not be feasible for some components due to form and configuration (i.e., heat exchanger tubes), and hardness testing only provides definitive results if baseline values are available for comparison. The qualitative method used in lieu of the hardness test would typically be an enhanced visual inspection consistent with ASME Section XI, VT-1 requirements. This qualitative method will be augmented, as necessary, by other NDE or metallurgical methods, as appropriate.

Enhancements

None.

Aging Management Program Elements

The elements, which are part of the MNGP Selective Leaching of Materials Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M33, “Selective Leaching Materials,” are also provided.

Scope of Program

The Monticello Nuclear Generating Plant Selective Leaching of Materials Program provides assurance that susceptible components intended functions are maintained during the period of extended operation. The program includes 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.

The Selective Leaching of Materials Program consists of activities that manage the aging effects for components of the following MNGP systems and/or structures:

Circulating Water	High Pressure Coolant Injection
Condensate Storage	Instrument and Service Air
Core Spray	Radwaste Solid & Liquid
Demineralized Water	Reactor Building Closed Cooling Water
Emergency Diesel Generators	Residual Heat Removal
Emergency Filtration Train	Reactor Core Isolation Cooling
Emergency Service Water	Service & Seal Water
Fuel Pool Cooling and Cleanup	Turbine Generator
Heating & Ventilation	Wells and Domestic Water

The program for selective leaching of materials ensures the integrity of components made of gray cast iron, bronze, brass, and other alloys exposed to a raw water, treated water, or a groundwater environment that may lead to selective leaching of one of the metal components.

Preventive Actions

The MNGP Selective Leaching of Materials Program will verify the ability of susceptible components to perform their intended function during the period of extended operation. The program's inspections are one-time, occurring before the period of extended operation, and thus do not include any preventive or mitigating attributes.

The MNGP Plant Chemistry Program contains requirements for monitoring of plant water chemistry to control pH and the concentration of corrosive contaminants thus reducing the potential for selective leaching.

Parameters Monitored or Inspected

The MNGP Selective Leaching of Materials Program will inspect a select set of susceptible components for the applicable aging effect, loss of material. The inspections will be performed before the beginning of the period of extended operation. The program includes a one-time visual inspection and hardness measurement of selected components that may be susceptible to selective leaching. In situations where hardness testing is not practical, a qualitative method by other NDE or metallurgical methods will be used.

Unacceptable inspection findings will be resolved using existing MNGP procedures, which will include an expansion of the sample size and location if needed.

Detection of Aging Effects

The MNGP Selective Leaching of Materials Program will include a one-time visual inspection and hardness measurement of selected components that may be susceptible to selective leaching.

The following exceptions are taken to the NUREG-1801 Program guidance:

1) The MNGP technical staff may use hardness testing, other than Brinell hardness testing, to identify the presence of selective leaching of material.

This exception is justified because there are other acceptable hardness tests, besides Brinell, that can provide equivalent testing results for components within the scope of this program.

2) Qualitative methods will be used in lieu of hardness testing to determine if selective leaching has occurred in situations where hardness testing is not practical.

This exception is justified because hardness testing may not be feasible for some components due to form and configuration (i.e., heat exchanger tubes), and hardness testing only provides definitive results if baseline values are available for comparison. The qualitative method used in lieu of the hardness test would typically be an enhanced visual inspection consistent with ASME Section XI, VT-1 requirements. This qualitative method will be augmented, as necessary, by other NDE or metallurgical methods, as appropriate.

Monitoring and Trending

The MNGP Selective Leaching of Materials Program does not include any requirements for monitoring or trending, since this is intended as a one-time inspection. Industry experience may be used to improve MNGP inspections.

Acceptance Criteria

Indications of selective leaching, detected by the MNGP Selective Leaching of Materials Program will be evaluated by the MNGP Corrective Action Program. Specific evaluation criteria will be developed for the program. However, an engineering evaluation will be performed before an affected component can be qualified for further service and if deemed necessary, the evaluation will include a root cause analysis.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

The MNGP Selective Leaching of Materials Program is a new program and thus does not have any operating experience. The program's one-time inspections are consistent with standard industry practice and NRC expectations as outlined in NUREG-1801.

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 program will provide reasonable assurance that the effects of aging on components susceptible to selective leaching will be adequately managed and able to perform their intended functions during the period of extended operation.

Conclusion

Implementation of the MNGP Selective Leaching of Materials Program will provide reasonable assurance that aging effects will necessarily be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation. The program will be implemented prior to the period of extended operation.

B2.1.31 Structures Monitoring Program

Program Description

The MNGP Structures Monitoring Program provides for aging management of structures and structural components within the scope of license renewal and implements the NUREG-1801, XI.S6, Structures Monitoring Program. The Structures Monitoring Program is based on the guidance provided in RG 1.160 and NUMARC 93-01. The Structures Monitoring Program is implemented as part of the structures monitoring done under the MNGP Maintenance Rule Program and with additional inspections of the Intake Structure and Diesel Fuel Oil Transfer House.

The Structures Monitoring Program also implements the NUREG-1801, XI.S5, Masonry Wall Program. Masonry block wall inspections are performed as part of the maintenance rule inspections and are based on IEB 80-11 with administrative controls per IN 87-67.

As permitted 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 in scope for 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.

NUREG-1801 Consistency

The MNGP Structures Monitoring Program is an existing program. It will be enhanced to be consistent with the recommendations of NUREG-1801, Chapter XI, Programs XI.S6, XI.S5, and XI.S7.

Exceptions to NUREG-1801

None.

Enhancements

The following enhancement(s) are required to satisfy the NUREG-1801 aging management program recommendations. Details of the enhancements are included in the appropriate element descriptions below. Enhancements are scheduled for completion prior to the period of extended operation.

- Scope of Program

  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.

  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.

- Parameters Monitored/ Inspected

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

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

- Acceptance Criteria

  Implementing procedures for the Structures Monitoring Program will be enhanced to include acceptance criteria for structural inspections of submerged portions of the Intake Structure.

Aging Management Program Elements

The elements, which are part of the MNGP Structures Monitoring Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Programs XI.S6, “Structures Monitoring Program”; XI.S5, “Masonry Wall Program”; and XI.S7, “Inspection of Water-Control Structures Associated with Nuclear Power Plants,” are also provided.

Scope of Program

The Structures Monitoring Program manages the aging effects of structures and structural components within the scope of License Renewal that are not covered by another aging management program. For example, aging management of structural components associated with Primary Containment is performed under the ASME Section XI, Subsection IWE Program. Aging management of structural components associated with Hangers and Supports is performed under the ASME Section XI, Subsection IWF and/or the System Condition Monitoring Programs. Aging management of cranes and reactor component handling equipment is performed under the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems Program. Aging management of the spent fuel pool liner and structural components within the pool is performed under the Plant Chemistry Program.

The Structures Monitoring Program includes masonry block walls and water control structures that are in scope for license renewal. The program also provides inspection requirements to manage aging effects as described in Parameters Monitored or Inspected.

The Structures Monitoring Program consists of activities that manage the aging effects for components of the following MNGP structures:

Diesel Fuel Oil Transfer House	Plant Control and Cable Spreading Structure
Emergency Diesel Generator Building	Primary Containment
Emergency Filtration Train Building	Radioactive Waste Building
High Pressure Coolant Injection Building	Reactor Building

Intake Structure (Includes Access Tunnel and Diesel Fire Pump House	Structures Affecting Safety (Includes Recombiner Building, Radwaste Storage and New Shipping Building, Turbine Building Addition, Hot Machine Shop, Heating Boiler Building, and Non-1E Electrical Equipment Room)
Miscellaneous SBO Yard Structures	Turbine Building
Off Gas Stack	Underground Bus Duct
Off Gas Storage and Compressor Building	

Preventive Actions

There are no preventive actions associated with the Structures Monitoring Program. The Structures Monitoring Program implements the NUREG-1801, XI.S5, Masonry Wall Program and the XI.S7, RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants Program, neither of which include preventative actions. These are monitoring programs only.

Parameters Monitored or Inspected

The parameters monitored or inspected under the MNGP Structural Monitoring Program include those that are identified in NUREG-1801, Chapter XI, Programs S5, S6 and S7 and that are related to maintenance of intended functions of the structures and structural elements incorporated into the scope of the program. Parameters monitored or inspected are commensurate with industry codes, standards and guidelines, and also consider industry and plant-specific operating experience.

Neither porous concrete sub-foundation materials nor de-watering systems are used at MNGP. Therefore, the issues of de-watering systems, erosion of porous concrete sub-foundations and settlement are not applicable. However, based on plant operating experience, special settlement inspections of the Diesel Fuel Oil Transfer House are performed.

Existing procedures will be enhanced to include the monitoring/ inspection parameters for all structural components within the scope of License Renewal. To ensure that the soil environment has remained non-aggressive, the program will be enhanced to include periodic groundwater sampling for pH, chloride concentration and sulfate concentration. Also, 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.

Detection of Aging Effects

Qualified personnel perform visual inspections of all structures within the Structures Monitoring Program in accordance with industry codes, standards and guidelines. The frequency of the inspections meets or exceeds the guidance provided by NEI 96-03, ACI 349.3R, RG 1.127 and ANSI/ASCE11-90.

Whenever inaccessible concrete areas are excavated, an inspection is performed. In addition, special inspections of critical structures are performed during and/or after extreme environmental conditions or natural phenomena (flood, tornado, etc.).

The method, extent and frequency of the Structural Monitoring Program inspections provide reasonable assurance of detection of applicable aging effects prior to a loss of intended function.

Monitoring and Trending

Structures and components, except submerged portions of the Intake Structure, are inspected in accordance with the MNGP maintenance rule program and therefore, monitoring and trending are in accordance with the maintenance rule. Inspections of the submerged portions of the Intake Structure are performed separate from the maintenance rule program. These inspections verify the adequacy and quality of maintenance and operating procedures for the submerged portions of the Intake Structure.

Acceptance Criteria

The Structures Monitoring Program inspection results are documented and evaluated by qualified personnel. Evaluations are based on ensuring that the intended functions of the structure or component are maintained. Inspected components are compared to previous reported conditions to determine the extent of any new degradation or changing condition. Acceptance criteria used to evaluate the need for corrective action of an observed degradation are identified in the Structures Monitoring Program and are based on industry guidelines/criteria such as ACI 349.3R-96. Qualified individuals combine industry guidelines/criteria and judgment to determine the need for corrective action.

The acceptance guidelines are based on a three-tiered hierarchy; acceptable, acceptable with deficiencies or unacceptable. A corrective action is initiated to document adverse (acceptable with deficiencies or unacceptable) conditions. If a structure or component is evaluated as acceptable with deficiencies, it is reviewed for possible 10 CFR 50.65 (a)(1) classification. If a structure or component is evaluated as unacceptable, it is expected the structure/component will be classified as 10 CFR 50.65 (a)(1).

Implementing procedures will be enhanced to include acceptance criteria for the structural inspections of the submerged portions of the Intake Structure.

Corrective Actions

Refer to Section B1.3.

NUREG-1801 program XI.S7 requires that an evaluation of the structure be performed when significant age-related deterioration and degradation from the original design basis are found. Per the MNGP Corrective Action Process, when significant component deterioration occurs, an evaluation is performed which includes a technical assessment (i.e. root cause), an evaluation of the current condition of the structure and recommendations for remedial or mitigating measures.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

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 twenty-one deficiencies and the 2001/2002 inspection noted thirty 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.

Conclusion

Implementation of the MNGP Structures Monitoring Program will provide reasonable assurance that aging effects will be managed so that the structures and structural components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.32 System Condition Monitoring Program

Program Description

The System Condition Monitoring Program is an existing plant-specific program that 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.

NUREG-1801 Consistency

The System Condition Monitoring Program is a plant specific program. The program will be consistent with the applicable ten elements described in Appendix A of NUREG-1800.

Exceptions to NUREG-1801

Not Applicable.

Enhancements

The following enhancement(s) are required to satisfy the NUREG-1801 aging management program recommendations. Details of the enhancements are included in the appropriate element descriptions below. Enhancements are scheduled for implementation prior to the period of extended operation.

- Parameters Monitored or Inspected

  Implementing instructions and procedures for the System Condition Monitoring Program will be revised to describe specific age degradation parameters to be monitored and inspected. Acceptance criteria will also be included.

Aging Management Program Elements

This is a plant specific program that consists of the appropriate ten elements described in Appendix A of NUREG-1800, Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants. Each element is described below.

Scope of Program

The System Condition Monitoring Program visually inspects and monitors the accessible external surfaces of systems and components that are within License Renewal scope for signs of excessive and/or abnormal aging effects and material degradation.

The System Condition Monitoring Program consists of activities that manage the aging effects for components of the following MNGP mechanical systems and civil/structure systems:

Alternate Nitrogen Supply	Instrument and Service Air
Automatic Pressure Relief	Main Condenser
Chemistry Sampling	Main Steam
Circulating Water	Primary Containment Mechanical
Combustible Gas Control	Radwaste Solid & Liquid
Condensate & Feedwater	Reactor Building
Condensate Storage	Reactor Building Closed Cooling Water
Control Rod Drive	Reactor Core Isolation Cooling

Core Spray	Reactor Head Vent
Demineralized Water	Reactor Recirculation
Emergency Diesel Generators	Reactor Vessel Instrumentation
Emergency Filtration Train	Reactor Water Cleanup
Emergency Service Water	Residual Heat Removal
Fire System	Secondary Containment
Fuel Pool Cooling and Cleanup	Service & Seal Water
Hangers & Supports	Standby Liquid Control
Heating & Ventilation	Turbine Generator
High Pressure Coolant Injection	Wells and Domestic Water

Scheduled and random system monitoring and inspection will detect the effects of external material degradation, if present, prior to a negative impact on the SSCs intended function.

Preventive Actions

There are no preventive actions associated with this aging management program (AMP). The objective of this AMP is to identify and manage the aging effects of concern prior to the loss of intended function (i.e., condition monitoring).

Parameters Monitored or Inspected

The System Condition Monitoring Program utilizes periodic plant system inspections and walkdowns to monitor for evidence of material degradation for mechanical systems/components and civil structures. Hanger and support, rack, panel, and anchorage material condition will also be inspected. Excessive and/or abnormal material degradation conditions such as cracking, paint deterioration (an indicator of possible underlying degradation), loose, worn or missing parts/components, fluid leaks, bolting or fastener degradation, evidence of corrosion and sealant deterioration, etc.

Implementing instructions and procedures will be revised to include specific parameters to be monitored and inspected. These parameters will be generated based on industry practices from INPO, EPRI, etc.

Detection of Aging Effects

The readily accessible external surfaces of various components (e.g. pump casings, valve bodies, piping, expansion joints) are visually inspected for leakage and evidence of excessive and abnormal material degradation. The minimum walkdown frequency is once per year for those systems and components that are accessible during normal operation. The inspection frequency may be increased based on the safety significance, production significance, and/or operating experience of each system. Systems and components that are only accessible during plant outages are inspected at least once per refueling interval.

Monitoring and Trending

The System Condition Monitoring Program is capable of detecting the effects of aging before a structure (refers to hangers and supports) or component's loss of function can occur. Visual inspections are performed at least once per year for those systems and components that are accessible during normal plant operation. The inspection frequency may be increased based on the safety significance, production significance, and operating experience of each system. Systems and components that are only accessible during plant outages are inspected at least once per refueling interval. These inspections and walkdowns provide timely detection of aging effects (i.e., prior to the loss of intended function). Inspection and walkdown results are documented to provide information for condition trending.

Acceptance Criteria

Normal design standards, procedural requirements, current licensing basis information, industry codes or standards (e.g., EPRI, INPO, etc.), will be used to determine acceptance criteria. Acceptance criteria will be included in implementing instructions and procedures for age related degradation such as corrosion, leakage, deformation, cracking and other adverse conditions that negatively impact the ability to perform a License Renewal intended function. References such as EPRI field guides will be used for acceptance criteria guidance.

Excessive or abnormal conditions not meeting acceptance criteria are entered into the corrective action process based on evaluation results.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

The System Condition Monitoring Program has been effective in monitoring system performance and, as enhanced, provides reasonable assurance that aging effects due to external visible aging mechanisms will be effectively managed. 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% completed as scheduled. Since data gathering began in May 2003, 100% 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. Of 82 systems tracked by System Health Reports, all but 3 systems meet or exceed performance expectations as of September 2004.

Conclusion

Implementation of the MNGP System Condition Monitoring Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B2.1.33 Thermal Aging & Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS)

Program Description

The MNGP Thermal Aging and Neutron Irradiation Embrittlement of Cast Austenitic Stainless Steel (CASS) Program monitors the aging effects of loss of fracture toughness on the intended function of the component by performing examinations on CASS reactor vessel internal components as part of the MNGP ASME Section XI 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.

NUREG-1801 Consistency

The Thermal Aging and Neutron Irradiation Embrittlement of CASS Program is an existing program. It is consistent with the recommendations of NUREG-1801 Chapter XI, Program XI.M13, “Thermal Aging and Neutron Irradiation Embrittlement of CASS.”

Exceptions to NUREG-1801

None.

Enhancements

None.

Aging Management Program Elements

The elements, which are part of the MNGP Thermal Aging and Neutron Irradiation Embrittlement of CASS Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter XI, Program XI.M13, “Thermal Aging and Neutron Irradiation Embrittlement of CASS,” are also provided.

Scope of Program

The scope of the MNGP Thermal Aging and Neutron Irradiation Embrittlement of CASS Program monitors the aging effects of loss of fracture toughness on the intended function of the component by performing examinations on CASS reactor vessel internal components as part of the MNGP In-Service Inspection Program. The program provides screening criteria to determine the susceptibility of CASS components to thermal aging on the basis of casting method, molybdenum content, and percent ferrite. 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 in accordance with the applicable ASME Section XI requirements and Tables IWB-2500-1.

The Thermal Aging and Neutron Irradiation Embrittlement of CASS Program manages the aging effects for components of the following systems and structures:

Reactor Pressure Vessel Internals

Preventive Actions

The MNGP Thermal Aging and Neutron Irradiation Embrittlement of CASS Program is a condition monitoring program that detects degradation of components before loss of intended function. Therefore, there are no preventive or mitigating attributes that are associated with these activities.

Parameters Monitored or Inspected

The aging effect parameter that is monitored/inspected with the MNGP Thermal Aging and Neutron Irradiation Embrittlement of CASS Program is loss of fracture toughness. The Thermal Aging and Neutron Irradiation Embrittlement of CASS Program is a condition monitoring program that detects and sizes flaws and defects by implementing the examination and inspection requirements of ASME Section XI with the applicable BWRVIP guidelines.

Detection of Aging Effects

The MNGP Thermal Aging and Neutron Irradiation Embrittlement of CASS Program is in accordance with the requirements of ASME Section XI and applicable BWRVIP guidelines to ensure that aging effects will be discovered and repaired before the loss of intended function. The nondestructive examination techniques used for detection of discontinuities, flaws, and defects within materials susceptible to loss of fracture toughness are the ultrasonic volumetric (UT), surface, and visual examination methods. The extent, schedule, technique, and personnel qualifications for the examinations are rigorously identified within the program.

Monitoring and Trending

The MNGP Thermal Aging and Neutron Irradiation Embrittlement of CASS Program prescribes the monitoring and trending of the CASS components. The program requirements for inspection schedule, extent, frequency, sequence of examinations, re-examinations, and additional examinations are in accordance with ASME Section XI, Article IWB-2000 and the applicable BWRVIP documents.

Acceptance Criteria

The MNGP Thermal Aging and Neutron Irradiation Embrittlement of CASS Program prescribes the acceptance criteria for the CASS components. The program requirements for acceptance, rejection, and analytical evaluation are in accordance with ASME Section XI, Articles IWB-3000.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

Based on a review of plant operating experience, the Thermal Aging and Neutron Irradiation Embrittlement of CASS Program has been effective in managing aging effects due to thermal aging and neutron irradiation embrittlement. Materials within the scope of the program are periodically examined and evaluated for corrective action as needed. In addition to ASME inspection requirements, vendor guidance (e.g., BWRVIP-03 and 41) is followed.

The program has demonstrated on several occasions that it provides reasonable assurance that aging effects are being managed for cast austenitic stainless steel. This is based on a review of past NRC inspection reports, INPO evaluations, audits, and self-assessments that noted program effectiveness and implementation of corrective actions to improve performance. These reports were generated for MNGP Cycle 21 and during MNGP Refueling Outage 21. The results of the ISI activities indicate that the integrity of the plant systems has been maintained.

Conclusion

The MNGP Thermal Aging and Neutron Irradiation Embrittlement of CASS Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B3 TLAA SUPPORT ACTIVITIES

B3.1 Environmental Qualification (EQ) of Electrical Components

Program Description

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, 10CFR50.49, dated February 22, 1983. This program describes EQ program attributes, and how those attributes ensure that the EQ Program remains effective throughout the license renewal period (60 years).

NUREG-1801 Consistency

The Electrical Equipment Subject to 10 CFR 50.49 Environmental Qualification (EQ) Requirements Program is an existing program. It is consistent with the recommendations of NUREG-1801, Chapter X, Program X.E1, “Environmental Qualification (EQ) of Electrical Components.”

Exceptions to NUREG-1801

None.

Enhancements

None.

Aging Management Program Elements

The elements, which are part of the MNGP Environmental Qualification Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter X, Program, X.E1, “Environmental Qualification of Electrical Components,” are also provided.

Scope of Program

In accordance with the requirements specified in 10CRF50.49, the MNGP EQ program provides for an evaluation of harsh environments in which electrical equipment important to safety may be required to operate. An equipment master list is maintained at MNGP that has been developed to encompass the requirements of paragraph (b) of 10 CFR 50.49. This master list includes safety-related electrical equipment and non-safety related electrical equipment whose failure could prevent accomplishment of safety functions, and certain post-accident monitoring equipment.

Preventive Actions

The MNGP EQ Program is an on-going program which ensures that electrical equipment important to safety is capable of performing its intended function in a harsh environment in accordance with 10 CFR 50.49. Although 10 CFR 50.49 does not require actions that prevent aging effects, MNGP EQ Program actions that could be viewed as preventative actions include (a) establishing the component service condition tolerance and aging limits (e.g., qualified life or condition limit), and (b) where applicable, requiring specific installation, inspection, monitoring or periodic maintenance actions to maintain component aging effects within the bounds of the qualification basis.

Parameters Monitored or Inspected

Although EQ component qualified life is not based on condition or performance monitoring, the EQ Coordinator is responsible for reviewing program data and industry information, determination of actions to be taken at MNGP which may include monitoring and/or inspection and confirming that completion of the actions have satisfactorily addressed potential MNGP environmental/functional issues.

Detection of Aging Effects

10 CFR 50.49 does not require the detection of aging effects for in-service components. The MNGP EQ Program credits the application of adjunct Preventative Maintenance (PM) and the Quality Control (QC) Programs to preclude the adverse effects of aging from becoming unacceptable, and to identify and correct aging effects when they are evident. In addition, a Motor Operated Valve (MOV) program has been implemented at MNGP which addresses identification of aging effects. Operator and system engineering rounds at MNGP are another means of providing continual oversight of this attribute.

Monitoring and Trending

10 CFR 50.49 does not require monitoring and trending of component condition or performance parameters of in-service components to manage the effects of aging. The MNGP EQ Coordinator is responsible for reviewing program data associated with the EQ program as well as subsequent assignment of actions to be taken at MNGP and confirming that completion of the actions have satisfactorily addressed potential EQ aging issues.

Acceptance Criteria

The MNGP EQ Program has identified all components subject to the acceptance criteria of 10 CFR 50.49 on a safety-related equipment master list. Calculations supporting equipment qualification are maintained by the EQ Coordinator. These calculations contain information such as location, environmental conditions, qualification methods and acceptance criteria. Prior to reaching the end of qualified life affected components are refurbished, re-qualified or replaced to ensure the continued functionality of the installed component.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

The MNGP EQ Program includes monitoring and assessment of industry information in order to assess its impact on EQ components at the MNGP. The EQ Coordinator is responsible for reviewing the disposition of such information, as well as subsequent assignment of actions to be taken and confirming that completion of the actions have satisfactorily addressed potential MNGP EQ aging issues.

The following examples provide objective evidence that the MNGP EQ program is responsive to externally identified operating experience items as well as proactive in self identification activities:

- NRC Safety System Design Inspection, March 2003, resulted in 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.

Conclusion

Implementation of the MNGP Electrical Equipment Subject to 10 CFR 50.49 Environmental Qualification (EQ) Requirements Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

B3.2 Metal Fatigue of the Reactor Coolant Pressure Boundary

Program Description

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.

NUREG-1801 Consistency

The Metal Fatigue of the Reactor Coolant Pressure Boundary Program is an existing program. It will be enhanced to be consistent with the recommendations of NUREG-1801, Chapter X, Program X.M1, "Metal Fatigue of the Reactor Coolant Pressure Boundary."

Exceptions to NUREG-1801

None.

Enhancements

The following enhancement is required to satisfy the NUREG-1801 aging management program recommendations. Details of the enhancement are included in the appropriate element descriptions below. Enhancements are scheduled for completion prior to the period of extended operation.

- Scope of Program

  Incorporate requirements for inclusion of NUREG/CR-6260 locations in implementing procedures for the MNGP Thermal Fatigue Monitoring Program.

Aging Management Program Elements

The elements, which are part of the MNGP Reactor Coolant Pressure Boundary Metal Fatigue Program, are described below. The results of an evaluation of each element against NUREG-1801, Chapter X, Program X.M1, “Metal Fatigue of Reactor Coolant Pressure Boundary,” are also provided.

Scope of Program

Metal fatigue of the reactor coolant pressure boundary is managed by the MNGP Thermal Fatigue Monitoring Program as augmented by environmental evaluations for applicable components identified in NUREG/CR-6260. In addition to components selected on the basis of plant transient effects, this program specifically provides for review of the primary pressure boundary components identified for "Older Vintage General Electric Plants" in NUREG/CR-6260 with regard to environmental conditions and their effects on metal fatigue.

These locations include:

Reactor Vessel Shell and Lower Head	Core Spray Line Reactor Vessel Nozzle and Associated Class 1 Piping
Reactor Vessel Feedwater Nozzle	Recirculation Inlet and Outlet Nozzles
RHR/Reactor Recirculation Piping	Reactor Vessel Feedwater Line Class 1 Piping

Preventive Actions

The MNGP Reactor Coolant Pressure Boundary Metal Fatigue Program is a monitoring program that predicts degradation of components before loss of intended function.

For fatigue analyses the change in stress, the stress range produced by a combination of transients (e.g. temperatures, flows, pressures) are compared to allowable limits. For a given stress range, the ASME Code allows a maximum number of cycles. In a fatigue analysis the actual or design assumed number of cycles is compared to the allowed maximum and these ratios are summed for all significant transients experienced by a component. This summation, which must be less than or equal to 1.0 (design code limit), is called the cumulative fatigue usage factor.

The MNGP program periodically evaluates cumulative fatigue usage at limiting locations and has taken into account the effect of environmental conditions. Consequently, the program ensures that adequate margin for cumulative fatigue usage will be maintained throughout the extended operating term.

Parameters Monitored or Inspected

The aging effect parameters that are monitored or inspected in support of the Metal Fatigue of Reactor Coolant Pressure Boundary Program are plant transients significant to limiting locations and environmental data, such as the dissolved oxygen content of RPV coolant that is used as input to environmental correction factor determination.

Typical data that is reviewed to identify and categorize plant transients includes system data obtained from the Plant Information System, temperature charts, control room logs, SCRAM reports, pre-startup checklists and cycle performance charts.

Detection of Aging Effects

The detection of aging effects as prescribed by the MNGP Reactor Coolant Pressure Boundary Metal Fatigue Program is confined to the projection of cumulative fatigue usage at the locations of interest. Program activities are conducted on a periodic basis of not less than once every refueling cycle. Since this program projects fatigue usage through the end of the period of extended operation, adequate lead time will exist from detection of a potential for exceeding fatigue acceptance criteria (analytical indicator of potential for crack initiation and growth) and the time necessary to reconcile the condition and avoid any loss of intended function due to fatigue failures.

Monitoring and Trending

Monitoring and trending of components evaluated under the Reactor Coolant Pressure Boundary Metal Fatigue Program consists of periodically re-evaluating locations where fatigue has been identified as limiting due to the accumulation of plant transients and the effect of environmental conditions. These locations include, as a minimum, those locations identified in NUREG/CR-6260 for "Older Vintage General Electric Plants." Plant transients and environmental data will be evaluated at least once every fuel cycle and projected through the period of extended operation to ensure that loss of function due to these factors does not occur.

Acceptance Criteria

The acceptance criteria for the Reactor Coolant Pressure Boundary Metal Fatigue Program consist of verifying that the cumulative fatigue usage remains at or below 1.0. If this cannot be demonstrated an alternate approach is to show that potential cracking is maintained below the criteria of ASME Section XI Appendix L, or an approved NRC limit.

To date all evaluations have been shown to be less than 1.0, with margin and the inclusion of environmental effects for selected locations.

Corrective Actions

Refer to Section B1.3.

Confirmation Process

Refer to Section B1.3.

Administrative Controls

Refer to Section B1.3.

Operating Experience

The MNGP technical staff monitors industry operating experience through peer groups, industry information (e.g. INs, LERs, SILs, etc.), and by communications with other plants subject matter experts. Information from these sources are evaluated for impact on the MNGP Reactor Coolant Pressure Boundary Metal Fatigue Program.

In addition, the MNGP technical staff updates 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 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.

Conclusion

Implementation of the MNGP Metal Fatigue of the Reactor Coolant Pressure Boundary Program will provide reasonable assurance that aging effects will be managed so that the systems and components within the scope of this program will continue to perform their intended functions consistent with the current licensing basis through the period of extended operation.

Appendix B References

1. NEI 95-10, Industry Guideline for Implementing the Requirements of 10 CFR Part 54 -The License Renewal Rule, Rev. 3, Nuclear Energy Institute, March 2001.
2. NUREG-1800, Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants, U.S. Nuclear Regulatory Commission, July 2001.
3. NUREG-1801, Generic Aging Lessons Learned (GALL) Report, U.S. Nuclear Regulatory Commission, July 2001.
4. 10 CFR 50, Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants.”
5. BWRVIP-130 (EPRI TR-1008192). BWR Water Chemistry Guidelines - 2004 Revision.
6. EPRI TR-1007820, Closed Cooling Water Chemistry Guideline, Revision 1, EPRI (Final Report, April 2004).
7. SAND 96-0344, “Aging Management Guideline for Commercial Nuclear Power Plants - Electrical Cable and Terminations,” Sandia National Laboratories for the U. S. Department of Energy, September 1996.
8. EPRI TR-109619, “Guideline for the Management of Adverse Localized Equipment Environments.”

APPENDIX C

(Not Used for This Application)

APPENDIX C
Contents

C1 APPENDIX C - NOT USED

APPENDIX D

TECHNICAL SPECIFICATION CHANGES

APPENDIX D
Contents

D1 APPENDIX D - TECHNICAL SPECIFICATIONS CHANGES

10 CFR 54.22 requires that an application for license renewal include any Technical Specification changes or additions that are necessary to manage the effects of aging during the period of extended operation. A review of the information provided in this License Renewal Application and the Monticello Nuclear Generating Plant Technical Specifications confirms that no changes to the Technical Specifications are necessary.

APPENDIX E

(Provided as Linked Document)

APPENDIX E
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E1 APPENDIX E - ENVIRONMENTAL REPORT

This page provides a link to the Environmental Report.