Amendment 22, LRA Changes from RAI Responses and Typographical Corrections

Enclosure 2 Summary Table

Affected LRA Section	LRA Page
Table 2.3.2-1	2.3-15
Table 3.1.2-2	3.1-86
Section A0	A-1
Table A4-1	A-36 through A-58
Section B1.2	B-1
Section B2.1.10	B-41 through B-45

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Corrected Table 2.3.2-1 to add Leakage Boundary (spatial) and Structural Integrity (attached) as intended functions for closure bolting in the Containment Spray System to be consistent with Table 3.2.2-1.

Table 2.3.2-1, Containment Spray System (Page 2.3-15), is revised as follows (new text shown underlined):

Table 2.3.2-1 Containment Spray System

Component Type	Intended Function
Closure Bolting	Leakage Boundary (spatial) Pressure Boundary Structural Integrity (attached)

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Corrected a typographical error in the Table 1 Item column. No new Plant Notes are added.

Table 3.1.2-2, Reactor Coolant System (Page 3.1-86), is revised as follows (new text shown underlined and deleted text shown in strikethrough):

Table 3.1.2-2 Reactor Vessel, Internals, and Reactor Coolant System – Summary of Aging Management Evaluation – Reactor Coolant System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Closure Bolting	LBS, PB, SIA	Stainless Steel	Plant Indoor Air (Ext)	Loss of material	Bolting Integrity (B2.1.8)	VII.I.AP-125	~~3.2.1.012~~ 3.3.1.012	A

A.0 APPENDIX A INTRODUCTION

Introduction

This appendix provides the information to be submitted in a Supplement to the Final Safety Analysis Report (FSAR) Update as required by 10 CFR 54.21(d) for the Callaway Plant License Renewal Application. Section A1 of this appendix contains summary descriptions of the programs used to manage the effects of aging during the period of extended operation. Section A2 contains summary descriptions of programs used for management of time-limited aging analyses during the period of extended operation. Section A3 contains evaluation summaries of TLAAs for the period of extended operation. Section A4 contains summary descriptions of license renewal commitments. Included in Section A4, Table A4-1, "*License Renewal Commitments*," are commitments for license renewal and an associated schedule for when Ameren Missouri plans to complete the commitments. Unless noted otherwise, the following implementation schedule will apply for new programs, enhanced programs, and specific activities to be completed prior to the period of extended operation (PEO).

a. Ameren Missouri shall implement those new programs and enhancements to existing programs no later than 6 months prior to PEO.

b. Ameren Missouri shall complete those inspection and testing activities by the 6-month date prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.

c. Ameren Missouri shall notify the NRC in writing within 30 days after having accomplished item (a) above and include the status of those activities that have been or remain to be completed in item (b) above.

These summary descriptions of aging management programs, time-limited aging analyses, and license renewal commitments will be incorporated in the Callaway Plant FSAR Update following issuance of the renewed operating license in accordance with 10 CFR 50.71(e).

A4 LICENSE RENEWAL COMMITMENTS

Table A4-1 identifies proposed actions committed to by Ameren Missouri for the Callaway Plant Unit 1 in its License Renewal Application. These and other actions are proposed regulatory commitments. This list will be revised, as necessary, in subsequent amendments to reflect changes resulting from NRC questions and Ameren Missouri responses. Ameren Missouri will utilize the commitment tracking system to track regulatory commitments.

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
1	Procedures will be enhanced to apply the elements of corrective actions, confirmation process, and administrative controls of the Callaway Plant Quality Assurance program to those nonsafety-related SSCs requiring aging management.	B1.3	Completed no later than six months p~~P~~rior to the PEO~~period of extended operation~~
2	Upon receipt of the renewed operating license, the station operating experience review process and Corrective Action Program will perform reviews of plant-specific and industry operating experience to confirm the effectiveness of the license renewal aging management programs, to determine the need for aging management programs to be enhanced, or indicate the need to develop a new aging management program. In order to provide additional assurance that internal and external operating experience related to aging management continues to be used effectively in the aging management programs, Callaway will enhance its operating experience program to: • Explicitly require the review of operating experience for age-related degradation. (Completed Amendment 18) • Establish criteria to define age-related degradation. In general, the criteria will be used to identify aging that is considered excessive relative to design, previous inspection experience, and inspection intervals. (Completed Amendment 18)	B1.4	Upon receipt of the renewed operating license

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	• Establish coding for use in identification, trending and communications of age-related degradation. This coding will assist plant personnel in ensuring that, in addition to addressing the specific issue, the adequacy of existing aging management programs is assessed. This could lead to AMP revisions or the establishment of new AMPs, as appropriate. (Completed Amendment 18) • Require communication of significant internal age-related degradation, associated with SSCs in the scope of license renewal, to the industry. Criteria will be established for determining when aging-related degradation is significant. (Completed Amendment 18) • Require review of external operating experience for information related to aging management, and evaluation of such information for potential improvements to Callaway aging management activities. License Renewal Interim Staff Guidance (LR-ISG) documents will be reviewed as part of this external operating experience information as they are issued on an ongoing basis, capturing new insights or addressing issues that emerge from license renewal reviews. (Completed Amendment 21) • Provide training to those responsible for screening, evaluating and communicating operating experience items related to aging-related degradation. This training will be commensurate with their role in the process. • Explicitly require AMP activities, criteria, and evaluations integral to the elements of the AMPs be included in the operating experience evaluation. (Completed Amendment 21)		
3	Enhance the Boric Acid Corrosion program procedures: • to include steel, copper alloy greater than 15 percent zinc, and aluminum as materials that are susceptible to boric acid corrosion. (Completed LRA Amendment 13) • so that system engineers will observe for signs of boric acid residue when	B2.1.4	Completed ~~Prior to the period of extended operation~~

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	performing system walkdowns. (Completed LRA Amendment 13) • to specify that the corrective actions taken by the program will include a consideration to modify the present design or operating procedures to mitigate or prevent recurrence of aging effects caused by borated water leakage. Consideration will be given to modifications that (a) reduce the probability of primary coolant leaks at locations where they may cause corrosion damage, and (b) entail the use of suitable corrosion resistant materials or the application of protective coatings or claddings. (Completed LRA Amendment 13)		
4	Implement the PWR Vessel Internals program as described in LRA Section B2.1.6. As part of the implementation activities address the following Applicant/Licensee Action Items (A/LAI) of NRC MRP-227-A Safety Evaluation dated December 16, 2011. Applicant/Licensee Action Item (A/LAI) #1 Each applicant/licensee is responsible for assessing its plant's design and operating history and demonstrating that the approved version of MRP-227 is applicable to the facility. Each applicant/licensee shall refer, in particular, to the assumptions regarding plant design and operating history made in the FMECA and functionality analyses for reactors of their design (i.e., Westinghouse, CE, or B&W) which support MRP-227 and describe the process used for determining plant-specific differences in the design of their RVI components or plant operating conditions, which result in different component inspection categories. The applicant/licensee shall submit this evaluation for NRC review and approval as part of its application to implement the approved version of MRP-227 Applicant/Licensee Action Item (A/LAI) #8 Item #5 (in part - reactor coolant system water environment portion)	B2.1.6	Within 24 months after the issuance of MRP-227-A, *PWR Internals Inspection and Evaluation Guideline*

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	For those cumulative usage factor (CUF) analyses that are TLAAs, the applicant may use the PWR Vessel Internals Program as the basis for accepting these CUF analyses in accordance with 10 CFR 54.21(c)(1)(iii) only if the RVI components in the CUF analyses are periodically inspected for fatigue-induced cracking in the components during the period of extended operation. The periodicity of the inspections of these components shall be justified to be adequate to resolve the TLAA. Otherwise, acceptance of these TLAAs shall be done in accordance with either 10 CFR 54.21(c)(1)(i) or (ii), or in accordance with 10 CFR 54.21(c)(1)(iii) using the applicant's program that corresponds to NUREG-1801, Revision 2, AMP X.M1, "Metal Fatigue of Reactor Coolant Pressure Boundary Program." To satisfy the evaluation requirements of ASME Code, Section III, Subsection NG-2160 and NG-3121, the existing fatigue CUF analyses should include the effects of the reactor coolant system water environment.		
5	Enhance the Bolting Integrity program procedures to: • reference NUREG-1339 and EPRI NP-5769 to meet the NUREG-1801 recommendations (Completed LRA Amendment 1) • include bolting in the list of items to be inspected during walkdowns. (Completed LRA Amendment 15)	B2.1.8	Completed~~Prior to the period of extended operation~~
6	Enhance the Open-Cycle Cooling Water System program procedures to: • include polymeric material inspection requirements, parameters monitored, and acceptance criteria. Examination of polymeric materials by OCCW System program will be consistent with examinations described in the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program. • inspect the essential service water strainers for coating degradation. • include inspection and cleaning, if necessary, of the air-side of safety-	B2.1.10	Completed no later than six months p~~P~~rior to the PEO~~period of extended operation~~. Inspections and testing to be completed no later than six months prior to the PEO or the end of the last

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	related air-to-water heat exchangers cooled by essential service water • inspect for coating detachment indications that affect downstream components during internal coatings inspections and specify acceptance criteria for coating detachment indications. Coatings detachments that are not repaired or removed to leave sound coating bonded to the surface will be evaluated to confirm coating manufacturer installation requirements, tested using techniques identified in ASTM-D7167 to confirm if the coating is bonded to the surface, and trended.		refueling outage prior to the PEO, whichever occurs later.
7	Enhance the Closed Treated Water Systems Program procedures to: • include visual inspections of the surfaces of components with a closed treated water systems water environment. Representative samples of each combination of material and water treatment program will be visually inspected at least every ten years or opportunistically when consistent with sample requirements. Sample locations will be selected based on the likelihood of corrosion and cracking. Inspections will be conducted and evaluated consistent with ASME Code inspections, industry standards, or a plant-specific inspection procedure by personnel qualified to detect aging. If adverse conditions are found, additional examinations will be performed. This periodic inspection will determine the extent of cracking, loss of material and fouling, and serves as a leading indicator of the condition of the interior of piping components otherwise inaccessible for visual inspection.	B2.1.11	Completed no later than six months p~~P~~rior to the PEO~~period of extended operation~~. Inspections to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.
8	Enhance the Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems program procedures to: • inspect crane structural members for loss of material due to corrosion and rail wear, and loss of preload due to loose or missing bolts and nuts. • include performance of periodic inspections as defined in the appropriate ASME B30 series standard for all cranes, hoists and equipment handling systems within	B2.1.12	Completed no later than six months p~~P~~rior to the PEO~~period of extended operation~~. Inspections to be completed no later than six months prior to PEO or

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	the scope of license renewal. For handling systems that are infrequently in service, such as those only used during refueling outages, periodic inspections may be deferred until just prior to use. • require evaluation of loss of material due to wear or corrosion and loss of bolting preload per the appropriate ASME B30 series standard. • require repairs to cranes, hoists and equipment handling systems per the appropriate ASME B30 series standard		the end of the last refueling outage prior to the PEO, whichever occurs later.
9	Enhance the Fire Protection program procedures to: • include visual inspections of the external surfaces of Halon fire suppression system components for excessive loss of material due to corrosion. • include trending of the performance of the Halon system during testing. (Completed LRA Amendment 1)	B2.1.13	Completed no later than six months p~~P~~rior to the PEO~~period of extended operation~~. Inspections and testing to be complete no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.
10	Recoat the internal surface of fire water storage tanks. Enhance the Fire Water System program procedures to: • include non-intrusive pipe wall thickness examinations on fire water piping to be performed every three years. Each three year sample will include at least three locations for a total of 100 feet of above-ground fire water piping and be selected based on system susceptibility to corrosion or fouling and evidence of performance degradation during system flow testing or periodic flushes. In addition, internal inspections will be performed on accessible exposed portions of fire water piping	B2.1.14	Completed no later than six months p~~P~~rior to the PEO ~~period of extended operation~~. Recoat the internal surface of the fire water storage tanks, inspections, and testing to be completed no later than six months prior to PEO or the end of the last

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	during plant maintenance activities. Pipe wall thickness examinations and internal inspections will be performed commencing after 2014 and throughout the period of extended operation. • replace sprinkler heads prior to 50 years in service or have a recognized testing laboratory field-service test a representative sample in accordance with NFPA 25 and test additional samples every 10 years thereafter to ensure signs of aging are detected in a timely manner. • review and evaluate trends in flow parameters recorded during the NFPA 25 fire water flow tests. • perform annual hydrant flow testing in accordance with NFPA 25 • perform annual hydrostatic testing of fire brigade hose		refueling outage prior to the PEO whichever occurs later.
11	Implement the Aboveground Metallic Tanks program as described in LRA Section B2.1.15	B2.1.15	Implementation started w~~W~~ithin the five-year period prior to the PEO~~period of extended operation~~. Completed no later than six months prior to the PEO. Inspections to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.
12	Remove the blisters in the coating, inspect the base metal for aging, and repair the coating in the Train A Emergency Diesel Generator Fuel Oil Storage Tank.	B2.1.16	Completed no later than six months p~~P~~rior to the

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	Enhance the Fuel Oil Chemistry program procedures to: • include periodic draining of the water from the bottom of the emergency fuel oil system day tanks, diesel fire pump fuel oil day tanks, and security diesel generator fuel oil day tank. • include the addition of biocide to the diesel fire pump fuel oil day tank and security diesel generator fuel oil day tank if periodic testing indicates biological activity or evidence of corrosion. • include draining, cleaning, and inspection of the emergency fuel oil system day tanks within the 10-year period prior to the period of extended operation and at least once every ten years after entering the period of extended operation. • include a determination of water and sediment in the periodic sampling of the emergency fuel oil system day tanks and security diesel generator fuel oil day tank. • include a determination of particulate concentrations in the periodic sampling of the emergency fuel oil system day tanks, diesel fire pump fuel oil day tanks, and security diesel generator fuel oil day tank. • include a determination of microbial activity concentrations in the periodic sampling of the emergency fuel oil system storage tanks, emergency fuel oil system day tanks, diesel fire pump fuel oil day tanks, and security diesel generator fuel oil day tank. • include new fuel oil receipt sampling for water and sediment prior to introduction into the security diesel generator fuel oil day tank and diesel fire pump fuel oil day tank. • perform a volumetric examination of the emergency fuel oil system storage tanks and day tanks after evidence of tank degradation is observed during the visual inspection within the 10-year period prior to the period of extended operation and		PEO~~period of extended operation~~. Inspections and referenced coating repairs to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	at least once every ten years after entering the period of extended operation. • perform a volumetric examination on the external surface of the diesel fire pump fuel oil day tanks and security diesel generator fuel oil day tank within the 10-year period prior to the period of extended operation and at least once every ten years after entering the period of extended operation. • include at least quarterly trending for water, biological activity, and particulate concentrations on the emergency fuel oil system day tanks, diesel fire pump fuel oil day tanks, and security diesel generator fuel oil day tank. • include immediate removal of accumulated water when discovered in the emergency fuel oil system day tank, diesel fire pump fuel oil day tank, and security diesel generator fuel oil day tank.		
13	Enhance the Reactor Vessel Surveillance program to: • determine the vessel fluence by ex-vessel dosimetry, following withdrawal of the final capsule. • require that pulled and tested surveillance capsules are placed in storage for future reconstitution or reinsertion unless given NRC approval to discard. • specifically require the design change process to evaluate the impact of plant operation changes on reactor vessel embrittlement. (Completed Amendment 14)	B2.1.17 4.2	Completed no later than six months p~~P~~rior to the PEO~~period of extended operation~~
14	Implement the One-Time Inspection program as described in LRA Section B2.1.18	B2.1.18	Implementation started w~~W~~ithin the 10-year period prior to the PEO~~period of extended operation~~. Completed no later than six months prior to the PEO. Inspections to be completed no later than six

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
			months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.
15	Implement the Selective Leaching program as described in LRA Section B2.1.19	B2.1.19	Implementation started w~~W~~ithin the five-year period prior to the PEO ~~period of extended operation~~. Completed no later than six months prior to the PEO. Inspections to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.
16	Implement the One-Time Inspection of ASME Code Class 1 Small-Bore Piping program as described in LRA Section B2.1.20	B2.1.20	Implementation started w~~W~~ithin the six-year period prior to the PEO~~period of extended operation~~. Completed no later than six months prior to the PEO. Inspections to be completed no later than six months prior to PEO or the end of the last

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
			refueling outage prior to the PEO, whichever occurs later.
17	Implement the External Surfaces Monitoring of Mechanical Components program as described in LRA Section B2.1.21	B2.1.21	Completed no later than six months pPrior to the PEOperiod of extended operation. Inspections to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.
18	Implement the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program as described in LRA Section B2.1.23	B2.1.23	Completed no later than six months pPrior to the PEOperiod of extended operation. Inspections to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.
19	Enhance the Lubricating Oil program procedures to: • indicate that lubricating oil contaminants are maintained within acceptable limits, thereby preserving an environment that is not conducive to loss of material or reduction of heat transfer,	B2.1.24	Completed no later than six months pPrior to the PEOperiod of extended operation. Inspections and

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	• state the testing standards for water content and particle count, and • state that phase separated water in any amount is not acceptable.		testing to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.
20	Implement the Buried and Underground Piping and Tanks program as described in LRA Section B2.1.25	B2.1.25	Implementation to be started w~~W~~ithin the 10-year period prior to the PEO ~~period of extended operation~~. Completed no later than six months prior to the PEO. Inspections to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.
21	Enhance the ASME Section XI, Subsection IWE program to: • specify that whenever replacement of bolting is required, bolting material, installation torque or tension, and use of lubricants and sealants are in accordance with the guidelines of EPRI NP 5769, EPRI TR 104213, and the additional recommendations of NUREG 1339, and • perform additional surface examinations of stainless steel penetration sleeves, dissimilar metal welds, bellows, and steel components that are subject to cyclic loading for cracking, unless Appendix J testing is adequate to identify cracking.	B2.1.26	Completed no later than six months p~~P~~rior to the PEO~~period of extended operation~~. Inspections and testing to be completed no later than six months prior to PEO or the end of the last refueling outage prior

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
			to the PEO, whichever occurs later.
22	Enhance the ASME Section XI, Subsection IWF program procedures to • specify that whenever replacement of bolting is required, bolting material, installation torque or tension, and use of lubricants and sealants are in accordance with the applicable EPRI guidelines, ASTM standards, AISC specifications, and NUREG-recommendations to prevent or mitigate degradation and failure of safety-related bolting due to stress corrosion cracking. Specifically, if ASTM A325, ASTM F1852, and/or ASTM A490 bolts are used, the preventive actions as discussed in Section 2 of the Research Council for Structural Connections "Specification for Structural Joints Using ASTM A325 or A490 Bolts" will be followed.	B2.1.28	Completed no later than six months pPrior to the PEOperiod of extended operation
23	Enhance the Structures Monitoring program procedures to: • include the main access facility into the scope of Structures Monitoring program. • specify that whenever replacement of bolting is required, bolting material, installation torque or tension, and use of lubricants and sealants are in accordance with the guidelines of EPRI NP 5769, EPRI NP 5067, EPRI TR 104213, and the additional recommendations of NUREG-1339. • specify the preventive actions for storage, lubricants, and stress corrosion cracking potential discussed in Section 2 of Research Council for Structural Connections publication Specification for Structural Joints Using ASTM A325 or A490 Bolts for ASTM A325, ASTM F1852, and/or ASTM A490 structural bolts. • specify inspections of penetrations, transmission towers, electrical conduits, raceways, cable trays, electrical cabinets/enclosures, and associated anchorages, and complete a baseline inspection of these components*. • specify that groundwater is monitored for pH, chlorides and sulfates, and every	B2.1.31	Completed no later than six months pPrior to the PEOperiod of extended operation with the exception of item indicated by *, which will be completed by December 31, 2017, and item indicated by #, for which initial inspections were completed by December 31, 2012, and any corrective actions resulting from initial inspections will be completed no later than

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	five years at least two samples are tested and the results are evaluated by engineering to assess the impact, if any, on below grade structures. • specify inspector qualifications in accordance with ACI349.3R-96. • quantify acceptance criteria and critical parameters for monitoring degradation, and to provide guidance for identifying unacceptable conditions requiring further technical evaluation or corrective action in accordance with the three tier quantitative evaluation criteria recommended in ACI 349.3R. • incorporate applicable industry codes, standards and guidelines for acceptance criteria. • specify that degradation associated with seismic isolation gaps, obstructions of these gaps, or questionable material in these gaps, will be evaluated by an engineer familiar with the seismic design of the plant, and the evaluation will consider the seismic isolation function in determining what corrective actions may be required. #		December 31, 2017. Inspections and testing to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.
24	Enhance the Protective Coating Monitoring and Maintenance Program procedures to: • specify parameters monitored or inspected to include; any visible defects, such as blistering, cracking, flaking, peeling, rusting, and physical damage. • specify inspection frequencies, personnel qualifications, inspection plans, inspection methods, and inspection equipment that meet the requirements of ASTM D 5163-08. • specify a pre-inspection review of the previous two monitoring reports and, based on inspection report results, prioritize repair areas as either needing repair during the same outage or as postponed to future outages, but under surveillance in the interim period. • specify characterization, documentation, and testing consistent with ASTM D 5163-08 section 10.2 through 10.4 and to specify an evaluation of the inspection reports by the responsible coating evaluation specialist who prepares a summary	B2.1.33	Completed no later than six months p~~P~~rior to the PEO~~period of extended operation~~. Inspections to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	of findings and recommendations for future surveillance or repair. • specify that the inspection reports prioritize repair areas as either needing repair during the same outage or as postponed to future outages, but under surveillance in the interim period.		
25	Enhance the Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program procedures to: • include all accessible in-scope cable in an adverse localized environment. • ensure there are no unacceptable visual indications of surface anomalies. All unacceptable visual indications of cable jacket and connection insulation surface anomalies will be subject to an engineering evaluation.	B2.1.34	Completed no later than six months p~~P~~rior to the PEO~~period of extended operation~~. Inspections to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.
26	Enhance the Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits program procedures to: • identify the scope of cables requiring aging management. • require engineering review of surveillance results every 10 years. • initiate corrective actions when surveillance results do not meet acceptance criteria, and to require an engineering evaluation be performed. When an unacceptable condition or situation is identified, a determination is also made as to whether the review of surveillance results or the cable testing frequency needs to be increased.	B2.1.35	Completed no later than six months p~~P~~rior to the PEO ~~period of extended operation~~. Inspections and testing to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.
27	Enhance the Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program procedures to: • identify the power cables (greater than or equal to 400 volts), manholes, pits and	B2.1.36	Completed no later than six months p~~P~~rior to the PEO~~period of extended~~

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	duct banks that are within the scope of the Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program. • Include periodic inspection of manholes, pits and duct banks, to confirm cables are not submerged or immersed in water, cables/splices and cable support structures are intact, and dewatering/drainage systems (i.e., sump pumps) and associated alarms operate properly. • Identify that inspections will be performed at least annually based on water accumulation over time and after event driven occurrences (e.g., heavy rain or flooding). In addition, operation of dewatering devices will be inspected and operation verified prior to any known or predicted heavy rain or flooding events. • ensure in-scope power cables are tested at least once every six years and adjusted based on test results and operating experience. • compare test results to previous test results to evaluate for additional information on the rate of cable degradation. • confirm cables are not submerged or immersed in water, cables/splices and cable support structures are intact, and dewatering/drainage systems (i.e., sump pumps) and associated alarms operate properly. Acceptance criteria for cable testing will be defined prior to each test. • require an engineering evaluation when the test or inspection acceptance criteria are not met.		~~operation~~. Inspections and testing to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.
28	Implement the Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program as described in LRA Section B2.1.37	B2.1.37	Completed no later than six months p~~P~~rior to the PEO~~period of extended operation~~. Inspections to be completed no later than six months prior to PEO or the end of the last

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
			refueling outage prior to the PEO, whichever occurs later.
29	Implement the Monitoring of Neutron-Absorbing Materials Other than Boraflex program as described in LRA Section B2.1.38	B2.1.38	Completed no later than six months pPrior to the PEOperiod of extended operation Inspections to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.
30	Implement the Metal Enclosed Bus program as described in LRA Section B2.1.39	B2.1.39	Completed no later than six months pPrior to the PEO period of extended operation. Inspections to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.
31	Enhance the Fatigue Monitoring program procedures to: • include fatigue usage calculations that consider the effects of the reactor water environment for a set of sample reactor coolant system locations. The set includes the NUREG/CR-6260 sample locations for a newer-vintage	B3.1	Completed no later than six months pPrior to the PEOperiod of extended operation

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	Westinghouse Plant and plant-specific bounding EAF locations. • ensure the scope includes the fatigue crack growth analyses, which support the leak-before-break analyses, ASME Section XI evaluations, and the HELB break selection criterion remain valid by counting the transients used in the analyses. • require the review of the temperature and pressure transient data from the operator logs and plant instrumentation to ensure actual transient severity is bounded by the design and to include environmental effects where applicable. If a transient occurs which exceeds the design transient definition the event is documented in the Corrective Action Program and corrective actions are taken. • include additional transients that contribute significantly to fatigue usage. These additional transients were identified by evaluation of ASME Section III fatigue and fatigue crack growth analyses. • include additional locations which receive more detailed monitoring. These locations were identified by evaluation of ASME Section III fatigue analyses and the locations evaluated for effects of the reactor coolant environment. The monitoring methods will be benchmarked consistent with the NRC RIS 2008-30. • project the transient count and fatigue accumulation of monitored components into the future. • include additional cycle count and fatigue usage action limits, which permit completion of corrective actions if the design limits are expected to be exceeded within the next 3 fuel cycles. The fatigue results associated with the NUREG/CR-6260 sample locations for a newer vintage Westinghouse plant and plant-specific bounding environmental-assisted fatigue locations will account for environmental effects on fatigue. The cycle count action limits for the hot leg surge nozzle will incorporate the 60-year cycle projections use in the hot leg surge nozzle EAF analysis. • include appropriate corrective actions to be invoked if a component approaches		

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	a cycle count or CUF action limit or if an experienced transient exceeds the design transient definition. If an action limit is reached, corrective actions include fatigue reanalysis, repair, or replacement. When a cycle counting action limit is reached, action will be taken to ensure that the analytical bases of the HELB locations are maintained. Re-analysis of a fatigue crack growth analysis must be consistent with or reconciled to the originally submitted analysis and receive the same level of regulatory review as the original analysis.		
32	Enhance the Concrete Containment Tendon Prestress program specification to: • include random samples for the 40, 45, 50, and 55 year surveillances. • extend the PLL lines for the vertical and hoop tendon groups to 60 years. • specifically require the final report for each surveillance interval to plot the measured results against time, and to include the Predicted Lower Limit, Minimum Required Value, and trend lines. • require a regression analysis consistent with the requirements of NRC Information Notice 99-10 Revision 1, Attachment 3.	B3.3 4.5	Completed no later than six months p~~P~~rior to the PEO~~period of extended operation~~
33	As additional industry and plant-specific applicable operating experience becomes available, it will be evaluated and incorporated into each new program.	B2.1.6 B2.1.15 B2.1.18 B2.1.19 B2.1.20 B2.1.21 B2.1.23 B2.1.25 B2.1.37 B2.1.38 B2.1.39	~~Prior to the period of the new program.~~ Completed consistent with implementation schedule noted with each referenced aging management program
34	Callaway replacement steam generator divider plate assemblies are fabricated of Alloy	Section	Between Fall 2025 and

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	690. The divider plate to primary head and tubesheet junctions are welded with Alloy 152 weld materials. The tubesheet cladding is Alloy 182 and the primary head cladding is stainless steel. There is a concern regarding potential failure at the divider plate welds to primary head and tubesheet cladding and Callaway commits to perform one of the following three resolution options: Option 1: Inspection Perform a one-time inspection of each steam generator to assess the condition of the divider plate welds. The examination technique(s) will be capable of detecting PWSCC in the divider plate assemblies and the associated welds. OR Option 2: Analysis Perform an analytical evaluation of the steam generator divider plate welds in order to establish a technical basis which concludes that the steam generator reactor coolant system pressure boundary is adequately maintained with the presence of steam generator divider plate weld cracking. The analytical evaluation will be submitted to the NRC for review and approval. OR Option 3: Industry/NRC Studies If results of industry and NRC studies and operating experience document that potential failure of the steam generator reactor coolant system pressure boundary due to PWSCC cracking of steam generator divider plate welds is not a credible concern, this commitment will be revised to reflect that conclusion.	3.1.2.2.11.1, Table 3.1.2-4	Fall 2029 when the replacement steam generators are in service for more than 20 years.
35	The material of steam generator tubesheet cladding is Alloy 182. The tubes are made of Alloy 690 and are secured to the tubesheet by means of tube to tubesheet leaktight weld and tube expansion. There is a concern regarding potential failure of primary-to-secondary pressure boundary due to PWSCC cracking of tube-to-tubesheet welds. Callaway commits to perform one of the following two resolution options:	Section 3.1.2.2.11.2, Table 3.1.2-4	Between Fall 2025 and Fall 2029 when the replacement steam generators are in service for more than 20 years.

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	Option 1: Inspection Perform a one-time inspection of a representative number of tube-to-tubesheet welds in each steam generator to determine if PWSCC cracking is present. The examination technique(s) will be capable of detecting PWSCC in the tube-to-tubesheet welds. If weld cracking is identified, the condition will be resolved through repair or engineering evaluation to justify continued service, as appropriate, and a periodic monitoring program will be established to perform routine tube-to-tubesheet weld inspections for the remaining life of the steam generators. OR Option 2: Analysis Perform an analytical evaluation of the steam generator tube-to-tubesheet welds either determining that the welds are not susceptible to PWSCC, or redefining the reactor coolant pressure boundary of the tubes, where the steam generator tube-to-tubesheet welds are not required to perform a reactor coolant pressure boundary function. The redefinition of the reactor coolant pressure boundary will be submitted as part of a license amendment request requiring approval from the NRC. The evaluation for determination that the welds are not susceptible to PWSCC and do not require inspection will be submitted to the NRC for review.		
36	Implement SBF or CBF consistent with RIS 2008-30 to monitor the CUF of the limiting location out of the pressurizer lower head, surge nozzle and heater penetrations to accommodate the insurge-outsurge transient. (Closed Amendment 11, re-evaluation of insurge-outsurge analysis demonstrate that this type of detailed monitoring was not necessary.)	4.3.1 4.3.2.2 B3.1	~~Prior to the period of extended operation~~ Closed
37	Complete an evaluation to determine if there are any additional plant-specific bounding EAF locations. The supporting environmental factors, F(en), calculations will be performed with NUREG/CR-6909 or NUREG/CR-6583 for carbon and low alloy steels, NUREG/CR-6909 or NUREG/CR-5704 for austenitic stainless steels, and NUREG/CR-	4.3.2.2 4.3.4	Completed no later than six months p~~P~~rior to the PEO~~period of extended operation~~

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
	6909 for nickel alloys. (Completed Amendment 2) In order to determine if the pressurizer contains a limiting EAF location, the fatigue analyses will be revised to incorporate the affect effect of insurge-outsurge transients on the pressurizer lower head, surge nozzle, and heater well nozzles at plant specific conditions. (Completed Amendment 2) Those non-NUREG/CR-6260 locations with an EAF CUF greater than 1.0 will be further evaluated using same methods as those used for NUREG/CR-6260 locations to remove conservatisms from the preliminary EAF CUF. The results of these final analyses will be incorporated into the Fatigue Monitoring program by either counting the transients assumed or incorporate the stress intensities into a CBF ability of the program. As an alternative, the Fatigue Monitoring program will implement SBFs of certain locations in order to ensure the component does not exceed an EAF CUF of 1.0. Any use of SBF will be implemented in compliance with RIS 2008-30. The pressurizer contains a limiting EAF location. The fatigue analyses will be revised to incorporate the effect of insurge-outsurge transients in the pressurizer lower head. (Completed Amendment 11)		
38	The number of the most severe RCP component cooling water transient, elevated CCW inlet temperature transients, will be limited to 75 percent of its design value, i.e. limited to 150, in order to accommodate the seasonal temperature change transient in the RCP thermal barrier flange fatigue analysis.	4.3.2.1	Completed no later than six months p~~P~~rior to the PEO~~period of extended operation~~

Table A4-1 License Renewal Commitments

Item #	Commitment	LRA Section	Implementation Schedule
39	NFPA 805 and LRA GAP analysis: A gap analysis of LRA Tables 2.3.3-20 and 3.3.2-20 will be provided to identify differences between the existing and NFPA 805 post-transition changes. The results and the impacts of these gaps on the fire protection program described in LRA Tables 2.3.3-20 and 3.3.2-20 will be summarized, as the basis for transitioning to the NFPA 805 nuclear safety capabilities. The summary will also list the fire protection systems and components including structural fire barriers, (e.g., fire walls and slabs, fire doors, fire barrier penetration seals, fire dampers, fire barrier coatings/wraps, equipment/personnel hatchways and plugs, metal siding), that will be added or removed based on the NFPA 805 transition in the scope of license renewal in accordance with 10 CFR 54.4(a) and whether they are subject to an AMR in accordance with 10 CFR 54.21(a)(1).	B2.1.13 B2.1.14	Prior to March 25, 2013. If the draft NFPA 805 Safety Evaluation Report is not available in February 2013, Ameren will provide an alternate schedule to address this commitment. (Revised Amendment 19)
40	Enhance the ASME Section XI, Subsection IWL program to specify that acceptability of concrete surfaces is based on the evaluation criteria provided in ACI-349.3R.	B2.1.27	Completed no later than six months p~~P~~rior to the PEO~~period of extended operation~~. Inspections to be completed no later than six months prior to PEO or the end of the last refueling outage prior to the PEO, whichever occurs later.

B1 APPENDIX B INTRODUCTION

B1.1 OVERVIEW

License renewal 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 Sections 3.1 through 3.6 of this application. Each aging management program described in this section has 10 elements that are consistent with the definitions in Section A.1, *Aging Management Review – Generic*, Table A.1-1, *Elements of an Aging Management Program for License Renewal*, of NUREG-1800, *Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants*. The 10 element detail is only provided when the program is plant-specific.

B1.2 METHOD OF DISCUSSION

For those aging management programs that are consistent with the assumptions made in Sections X and XI of NUREG-1801, or are consistent with exceptions, each program discussion is presented in the following format:

- 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 is provided.
- Enhancements to ensure consistency with NUREG-1801 or additions to the NUREG-1801 program to manage aging for additional components with aging effects not assumed in NUREG-1801 for the NUREG-1801 program. ~~A proposed schedule for completion is discussed.~~
- Operating experience information specific to the program is provided.
- A conclusion section provides a bases statement of reasonable assurance that the program is effective, or will be effective, once enhanced.

Included in Section A4, Table A4-1, "*License Renewal Commitments*," are commitments for license renewal and an associated detailed schedule for when Ameren Missouri plans to complete the commitments related to these aging management programs.

B2.1.10 Open-Cycle Cooling Water System

Program Description

The Open-Cycle Cooling Water (OCCW) System program manages loss of material, reduction of heat transfer, cracking, blistering, change in color, and hardening and loss of strength for those components that are exposed to the raw water environment of the essential service water (ESW) system and heat exchangers and other components in other systems serviced by the essential service water system.

The activities for this program are consistent with the Callaway commitments to the requirements of NRC Generic Letter 89-13, *Service Water System Problems Affecting Safety-Related Components* and provide for management of aging effects in raw water cooling systems through tests, inspections and component cleaning. System and component testing, visual inspections, nondestructive examination (i.e., ultrasonic testing and eddy current testing), and biocide and chemical treatment are conducted to ensure that aging effects are managed such that system and component intended functions and integrity are maintained.

Periodic heat transfer testing or inspection and cleaning of heat exchangers with a heat transfer intended function is performed in accordance with Callaway commitments to NRC Generic Letter 89-13 to verify heat transfer capabilities.

Routine inspections and maintenance of the OCCW System program ensure that corrosion, erosion, sediment deposition and biofouling cannot degrade the performance of safety-related systems serviced by the essential service water system.

The guidelines of NRC Generic Letter 89-13 are utilized for the surveillance and control of biofouling. Procedures provide instructions and controls for biocide injection. Periodic inspections are performed for the presence of mollusks and biocide treatments are applied as necessary.

System walkdowns are performed periodically to assess the material condition of OCCW system piping and components. Compliance with the licensing basis is ensured by review of system design basis documents as well as periodic performance of self assessments.

Callaway uses internal coatings only on the component cooling water heat exchanger end bells, channels, and tubesheets; the control room air conditioner tubesheets; the class 1E electrical equipment air conditioner tubesheets; and the essential service water system strainers. This amount of coating surface area is relatively small and its aging has not been a concern for essential service water system performance.

Examination of polymeric materials by OCCW System program will be consistent with examinations described in the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program (B2.1.23).

The external surfaces of the buried OCCW components are managed by the Buried and Underground Piping and Tanks program (B2.1.25). The aging management of closed-cycle cooling water systems is described in B2.1.11, Closed Treated Water Systems program, and is not included as part of this program.

NUREG-1801 Consistency

The Open-Cycle Cooling Water System program is an existing program that, following enhancement, will be consistent with NUREG-1801, Section XI.M20, *Open-Cycle Cooling Water System*.

Exceptions to NUREG-1801

None

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented in the following program elements:

Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), and Acceptance Criteria (Element 6)

Procedures will be enhanced to include polymeric material inspection requirements, parameters monitored, and acceptance criteria. Examination of polymeric materials by OCCW System program will be consistent with examinations described in the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components program (B2.1.23).

Procedures will be enhanced to include inspection and cleaning, if necessary, of the air-side of safety-related air-to-water heat exchangers cooled by essential service water.

Procedures will be enhanced to inspect the essential service water strainers for coating degradation.

Preventive Actions (Element 2), Parameters Monitored or Inspected (Element 3), Detection of Aging Effects (Element 4), Monitoring and Trending (Element 5) and Acceptance Criteria (Element 6)

Procedures will be enhanced to inspect for coating detachment indications that could affect downstream components during internal coatings inspections and specify acceptance criteria for coating detachment indications. Coatings detachments that are not repaired or removed to leave sound coating bonded to the surface will be evaluated to confirm coating manufacturer installation requirements, tested using techniques identified in ASTM-D7167 to confirm if the coating is bonded to the surface, and trended.

Operating Experience

The following discussion of operating experience provides objective evidence that the Open-Cycle Cooling Water System program will be effective in ensuring that intended functions are maintained consistent with the current licensing basis for the period of extended operation:

1. In 2000, during routine maintenance, Asiatic clams were found in an RHR room cooler, blocking approximately 15 percent of the tubes. In subsequent inspections, clams were found in several service water and essential service water heat exchangers and room coolers. It was determined that the clams originated in the waste treatment clearwell, from which they were flushed into the suction of the service water pumps. The service water pumps distributed the clams to the heat exchangers and room coolers. As corrective action, procedures were strengthened to require more frequent inspections and provide for a more robust chemistry program to control the clams. Corrective action also included plant modifications, such as installing strainers on the discharge line of the service water pumps.

2. In 2001, through-wall corrosion had been observed in the RHR pump room cooler. The exact cause could not be determined but was believed to be from microbiologically influenced corrosion attack. The cooler was repaired.

3. Performance of the containment coolers degraded over time due to debris from the service water system, so that by 2001 there was very little margin available. The design of the original containment cooler coils did not allow them to be mechanically cleaned, and flushing was ineffective. The coils for containment coolers A and B were replaced in Refuel 11 (Spring 2001), and the coils for C and D were replaced in Refuel 12 (Fall 2002). The replacement coils have a removable cover plate which permits access to mechanically clean individual tubes.

4. In 2007, Callaway revised the program so that the component cooling water heat exchangers are the only heat exchangers that are performance tested. In order to maintain heat removal capability of the other NRC Generic Letter 89-13 heat exchangers, Callaway cleans and inspects heat exchangers at regular intervals, as well as performs flow and pressure measurements according to the essential service water flow balance procedure. The inspections check for micro-fouling, and include thermographies or ultrasonic examinations of internal surfaces. These maintenance activities supplement the commitment to thermal performance testing made in response to NRC Generic Letter 89-13. The primary and additional monitoring methods have been determined for each of the NRC Generic Letter 89-13 heat exchangers, in accordance with the guidance of EPRI Technical Report 1007248, *Alternative to Thermal Performance Testing and/or Tube-side Inspections of Air-to-Water Heat Exchangers*.

5. From 2008 to 2009, the buried portions of the ESW supply from the ESW pump house and return to the ultimate heat sink cooling tower were replaced with high-density polyethylene (HDPE) piping. In addition, sections of above ground or underground carbon steel piping that interfaces with the buried piping was replaced with stainless steel piping. These modifications were performed as a result of the material condition of the ESW system. These modifications were performed as a result of corrective action documents that have been written concerning pinhole leaks, pitting, and other localized degradation of the ESW piping system.

6. In 2009, the replacement of the emergency diesel generator jacket water heat exchangers was evaluated due to loss of material in the tubes. The evaluation determined that a better material of construction and a better design would minimize aging effects due to raw water environment in the emergency diesel generators. The replacement jacket water heat exchangers and the emergency diesel generator lube oil coolers had tubes made of AL6XN stainless steel and were replaced in Refuel 17 (Spring 2010). The emergency diesel generator intercoolers were replaced in Refuel 18 (Fall 2011), and also have tubes fabricated from AL6XN stainless steel.

7. In 2009, room cooler flow rates had been observed to be low in the RHR pump room cooler and the containment spray pump room cooler. The low flow rates were determined to be from material that was dislodged during weld repairs from the outage prior to flow testing. The coolers were flushed to remove the debris, and flow rates were restored to their normal operating condition.

8. Prior to 2010, the coils for the following safety-related room coolers were replaced due to performance or aging issues: auxiliary building north penetration room cooler, auxiliary building south penetration room cooler, component cooling water pump room cooler train A, component cooling water pump room cooler train B, and spent fuel pool room cooler A. The material for the replacement coils is AL6XN stainless steel.

The above examples provide objective evidence that the existing Open-Cycle Cooling Water System program preventive, condition, and performance monitoring activities prevent or detect aging effects. Occurrences that would be identified under the Open-Cycle Cooling Water System program will be evaluated to ensure there is no significant impact to safe operation of the plant and corrective actions will be taken to prevent recurrence. Guidance for re-evaluation, repair, or replacement is provided for locations where aging is found. There is confidence that the continued implementation of the Open-Cycle Cooling Water System program will effectively identify aging prior to loss of intended function.

Conclusion

The continued implementation of the Open-Cycle Cooling Water System program, following enhancement, 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 for the period of extended operation.