



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

August 9, 2012

Mr. Adam C. Heflin
Senior Vice President and Chief
Nuclear Officer
Union Electric Company
P.O. Box 620
Fulton, MO 65251

SUBJECT: AGING MANAGEMENT PROGRAMS AUDIT REPORT REGARDING THE
CALLAWAY PLANT UNIT 1 LICENSE RENEWAL APPLICATION (TAC
NO. ME7708)

Dear Mr. Heflin:

By letter dated December 15, 2011, Union Electric Company d/b/a Ameren Missouri (the applicant) submitted an application for renewal of operating license NPF-30 for the Callaway Plant Unit 1 (Callaway). On May 10, 2012, the staff of the U.S. Nuclear Regulatory Commission (NRC or the staff) completed the on-site audit of aging management programs. The audit report is enclosed.

If you have any questions, please contact me by telephone at 301-415-2946 or by e-mail at Samuel.CuadradoDeJesus@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "Samuel Cuadrado de Jesús".

Samuel Cuadrado de Jesús, Project Manager
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosure:
As stated

cc w/encl: Listserv

U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION, DIVISION OF LICENSE RENEWAL

Docket No: 50-483

License No: NPF-30

Licensee: Union Electric Company d/b/a Ameren Missouri

Facility: Callaway Plant Unit 1

Location: Callaway County, Missouri

Dates: April 30, 2012–May 10, 2012

Reviewers: S. Cuadrado de Jesús, Project Manager, Division of License Renewal (DLR)
B. Harris, Project Manager, DLR
R. Auluck, Branch Chief, DLR
B. Pham, Branch Chief, DLR
M. Marshall, Branch Chief, DLR
W. Holston, Mechanical Engineer, DLR
J. Klos, Mechanical Engineer, DLR
M. Kichline, Mechanical Engineer, DLR
J. Wise, Mechanical Engineer, DLR
R. Sun, Mechanical Engineer, DLR
K. Green, Mechanical Engineer, DLR
J. Gavula, Mechanical Engineer, DLR
W. Gardner, General Scientist, DLR
K. Karwoski, Sr. Advisor Steam Generator Integrity, DE
A. Obodoako, Materials Engineer, DE
C. Hunt, Chemical Engineer, DE
J. Burke, Mechanical Engineer, DE
M. Vera, Project Manager, DLR
T. Marenchin, Project Manager, DLR
C. Ng, Mechanical Engineer, DLR
B. Fu, Mechanical Engineer, DLR
S. Min, Mechanical Engineer, DLR
O. Yee, Mechanical Engineer, DLR
C. Sydnor, Mechanical Engineer, DE
D. Brittner, Mechanical Engineer, DLR
R. Kalikian, Materials Engineer, DLR
J. Medoff, Mechanical Engineer, DLR
M. Yoo, General Engineer, DLR
B. Lehman, Structural Engineer, DLR
A. Prinaris, Structural Engineer, DLR
A. Sheikh, Structural Engineer, DLR

ENCLOSURE

- A. Istar, Structural Engineer, DLR
- C. Doutt, Sr. Electrical Engineer, DLR
- D. Nguyen, Electrical Engineer, DLR
- R. Li, Electrical Engineer, DLR
- R. Royal, Consultant (Advanced Technologies and Laboratories)
- D. Naus, Consultant (Oak Ridge National Lab)

Approved By:

Rajender Auluck, Chief
Aging Management of Plant Systems Branch
Division of License Renewal

Billy Rogers, Chief
Aging Management of Reactor Systems and Guidance Update Branch
Division of License Renewal

Michael Marshall, Chief
Aging Management of Structures, Electrical, and Systems Branch
Division of License Renewal

Introduction

The U.S. Nuclear Regulatory Commission (NRC or the staff) conducted a 10-day audit at the Callaway Plant Unit 1 (Callaway), in Callaway County, MO, from April 30 to May 10, 2012. The purpose of this audit was to examine Union Electric Company d/b/a Ameren Missouri (the applicant's) aging management programs (AMPs) and related documentation to verify the applicant's claim of consistency with the corresponding AMPs in NUREG-1801, Revision 2, "Generic Aging Lessons Learned (GALL) Report," dated December 2010. As described in the GALL Report, the staff based its evaluation of the adequacy of each AMP on its review of the following 10 program elements in each AMP: 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.

Exceptions to the GALL AMP elements will be evaluated separately as part of the staff's review of the Callaway license renewal application (LRA) and documented in the staff's safety evaluation report (SER).

NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants" (SRP-LR), Revision 2, dated December 2010, provides staff guidance for reviewing an LRA. The SRP-LR allows an applicant to reference in its LRA, the AMPs described in the GALL Report. By referencing the GALL Report AMPs, the applicant concludes that its AMPs correspond to those AMPs reviewed and approved in the GALL Report and that no further staff review is required. If an applicant credits an AMP for being consistent with a GALL Report program, it is incumbent on the applicant to ensure that the plant program contains all of the elements of the referenced GALL Report program. The applicant's determination should be documented in an auditable form and maintained on site.

During this audit, the staff audited AMP elements 1–6, and 10 ("scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "operating experience"). These elements of the applicant's AMPs were claimed to be consistent with the GALL Report and were audited against the related elements of the associated AMP described in the GALL Report, unless otherwise indicated in this audit report. Elements 7–9 ("corrective actions," "confirmation process," and "administrative controls") were audited during the scoping and screening methodology audit conducted April 16–19, 2012, and are evaluated separately. The staff audited all AMPs that the applicant stated were consistent with the GALL Report AMPs.

During this audit, if an applicant took credit for a program in the GALL Report, the staff verified that the plant program contains all the elements of the referenced GALL Report program. In addition, the staff verified the conditions at the plant were bounded by the conditions for which the GALL Report program was evaluated.

In performing this audit, the staff examined the applicant's LRA, program-bases documents, and related references; interviewed various applicant representatives; and conducted walkdowns of several plant areas. In total, 42 AMPs were reviewed and 45 breakout (discussion) sessions with applicant representatives were conducted. This report documents the staff's activities during this audit.

LRA AMP B2.1.1, ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD

Summary of Information in the Application. The LRA states that AMP B2.1.1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD,” is an existing program that is consistent with the program elements in GALL Report AMP XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC and IWD.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “cracking,” “leak,” “flaw,” “failure,” “degradation,” and “weld.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. EDP-ZZ-01003	Inservice Inspection Program	Revision 25
2. LO-WTGGIN-2004-001	Change of Inspection Frequency of N-10 Nozzle	07/30/2005
3. CEP-RR-001	American Society of Mechanical Engineers (ASME) Section XI Repair/Replacement Program	12/09/2010
4. Calculation EF-109	Design Min Wall Calculation	Revision 0
5. QCP-ZZ-05000	Liquid Penetration Examination	Revision 21
6. QCP-ZZ-05010	Magnetic Particle Examination	Revision 15
7. QCP-ZZ-05025	Ultrasonic Examination of Austenitic Pipe Welds	Revision 10
8. QCP-ZZ-05026	Ultrasonic Examination of Ferritic Pipe Welds	Revision 9
9. QCP-ZZ-05040	Visual Examination to ASME VT-1	Revision 21
10. CAR 201010669	Detail information for CAR 201010669-RCS Leakage CVCS Letdown Orifice	11/12/2010
11. ML0421804040	ISI Summary Report - RFO 10	12/03/1999
12. ML0421804070	ISI Summary Report - RFO 11	02/21/2003
13. ML0421804020	ISI Summary Report - RFO 12	06/11/2004
14. ML071770133	ISI Summary Report - RFO 14	06/18/2007
15. CAR 200809886	CARs and Action INPO Report. Detail information for CAR 200809886	08/03/2011
16. E170.0105	Callaway NPP Third Interval Inservice Inspection Plan	Revision 5
17. CAR 199501891	RCS Leak Detected in Line BB-74-BCA-2”	10/04/1995
18. CAR 201011236	Localized Pitting on 8 NPS SCH 40 Pipe	Revision 0

During the audit of program elements 1–6, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. For the “detection of aging effects” and “monitoring and trending” program elements insufficient information was available to determine if they were consistent with the

corresponding program elements in the GALL Report AMP. To obtain the information necessary to verify if these program elements are consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing RAIs for the subjects discussed below.

The staff reviewed the applicant's Inservice Inspection (ISI) Summary Reports dated from 1999 to 2012 and noted that pin hole leaks in the site's essential service water (ESW) system piping have been detected. Pinhole leaks also have been detected in the chemical and volume control system letdown piping. During the onsite audit of the American Society of Mechanical Engineers (ASME) Section XI Inservice Inspection, Subsections IWB, IWC and IWD Program, the staff reviewed documents indicating that, as mitigative measures, the applicant enhanced its water chemistry control and replaced some of the degraded piping with more corrosion-resistant stainless steel piping during the current 10-year ISI interval, which began on December 19, 2004. However, based on recent inspection results, as documented in the ISI Summary Reports during the current 10-year ISI interval, the staff noted that there were more pinhole leaks detected and repaired, and that the degradation had not been alleviated. In addition, during its onsite audit, the staff reviewed documents indicating that there is still an extensive amount of carbon steel piping in the system that is susceptible to similar degradation. Therefore, the staff lacks sufficient information to conclude that the AMPs "detection of aging effects" program element will be effective in timely detection of aging effects, and the "monitoring and trending" program element will be effective in providing timely corrective or mitigative activities to adequately manage the effects of aging so that the intended function(s) will be maintained consistent with the current licensing basis (CLB) during the period of extended operation.

During the audit of the "operating experience" program element, the staff determined that the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff's independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the final safety analysis report (FSAR) supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements "scope of program," "preventive actions," "parameters monitored or inspected," and "acceptance criteria" are consistent with the corresponding program elements in the GALL Report AMP XI.M1. The staff also identified certain aspects of LRA program elements "detection of aging effects," and "monitoring and trending" that will require additional information or evaluation is required before consistency can be determined.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.2, Water Chemistry

Summary of Information in the Application. The LRA states that AMP B2.1.2, “Water Chemistry,” is an existing program that is consistent with the program elements in GALL Report AMP XI.M2, “Water Chemistry.” To verify this claim of consistency, the staff audited the LRA AMP.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant’s operating experience database using the keywords: “chloride,” “conductivity,” “dissolved oxygen,” “sulfate,” and “fouling.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1.	Callaway Plant Unit 1 License Renewal Application	12/15/2011
2. APA-ZZ-01020	Primary Chemistry Program	Revision 021
3. APA-ZZ-01021	Secondary Chemistry Program	Revision 030
4. APA-ZZ-01021, Addendum 1	Action Level Limits Part I and Part II	Revision 005
5. APA-ZZ-01021, Addendum 2	Non-Routine Sampling Schedule	Revision 002
6. APA-ZZ-01021, Addendum 3	Secondary Water Chemistry Strategic Optimization Plan	Revision 003
7. CDP-ZZ-0200	Chemistry Schedule and Water Specs	Revision 092
8. CDP-ZZ-0200, Appendix A	Water Makeup and Storage Tables	Revision 011
9. CDP-ZZ-0200, Appendix B	Primary Plant System Tables	Revision 025
10. CDP-ZZ-0200, Appendix C	Secondary Plant System Tables	Revision 017
11. CTO-ZZ-01020	Off Normal Primary Chemistry Corrective Action	Revision 007
12. CTO-ZZ-01021	Off Normal Secondary Chemistry Corrective Actions	Revision 013
13. EDP-BB-01341	Steam Generator Surveillance	Revision 006
14. CTP-ZZ-01000	Miscellaneous Sampling Guidelines	Revision 007
15. CTP-SJ-01102	Auxiliary Building Sample Station (SJ-143) Operation	Revision 037
16. CTP-RM-01205	RM Panel Sampling	Revision 023
17. CDP-ZZ-00110	Chemistry Data Trending Program	Revision 004

During the audit of program elements 1–6, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that the LRA program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.M2.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.3, Reactor Head Closure Stud Bolting Program

Summary of Information in the Application. The LRA states that AMP B2.1.3, “Reactor Head Closure Stud Bolting Program” is an existing program that is consistent with the program elements in GALL Report AMP XI.M3, “Reactor Head Closure Stud Bolting.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “bolt,” “bolting,” “closure stud,” “stress corrosion cracking (SCC),” “wear,” and “cracking.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.3	Reactor Vessel Head Stud Cleaning and Lubrication	Revision 2, 10/05/2011
2. ETP-BB-03150	Reactor Vessel Head Stud Cleaning and Lubrication	Revision 14
3. ETP-BB-03155	Reactor Vessel Head Stud Installation	Revision 15
4. ETB-BB-03156	Reactor Vessel Head Stud Tensioning	Revision 19
5. ETP-BB-03165	Reactor Vessel Head Stud Removal	Revision 12
6. ETP-BB-03147	Reactor Vessel Head Removal – IPTe	Revision 16
7. EDP-ZZ-01003	Inservice Inspection Program	Revision 25

Document	Title	Revision/Date
8. E 170.0105	Callaway NPP Third Interval ISI Program Plan	Revision 5 10/14/2011
9. QCP-ZZ-05040	Visual Examination to ASME VT-1	Revision 21
10. QCP-ZZ-05041	Visual Examination to ASME VT-2	Revision 25
11. AUE-UT-98-5	Ultrasonic Examination of Studs/Bolts Greater than Two Inches in Diameter	03/02/07
12. APA-ZZ-00107	Review of Current Industry Operating Experience	Revision 19
13. DEI-234	Stuck Stud Evaluation – Callaway Unit 1 Reactor Vessel	October 1987
14. DEI-260	Flange Thread Degradation Callaway Unit 1 Reactor Vessel	March 1989
15. CAR 199601632	Reactor Head Stud # 18 Stuck in the Reactor Vessel	10/31/1996
16. RFR 17464	Material Equivalency: Use 2 Spacers in RV Bolting	10/31/1996
17. BB-131	Stress Calculation to Justify the #18 Stud being stuck with 2-5/8" less thread engagement than design	10/31/1996
18. APA-ZZ-00662	ASME Section XI Repair/Replacement Program	Revision 19
19. CAR 200404261	RV Stud Hole # 20 Had Rolled Lead Thread	05/20/2004

During the audit of program elements 1-6, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. For the “detection of aging effects,” and “monitoring and trending” program elements insufficient information was available to determine if they were consistent with the corresponding program elements of the GALL Report AMP. To obtain the information necessary to verify if these program elements are consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing RAIs for the subjects discussed below.

During the review of the LRA and the audit of the applicant’s operating experience for the AMP, the staff noted that the Callaway plant had several occasions when reactor pressure vessel (RPV) closure studs were found to be stuck during stud insertion or removal activities. In some cases, the studs had to be either cut or forcibly removed from their RPV flange stud hole locations. In addition, during the audit the staff noted numerous cases in which the RPV lower flange stud holes have either damaged threads, or if the thread regions were repaired the stud holes had fewer threads than were originally designed. Stuck studs or damaged threads were detected during plant refueling or cold shutdown activities and the amount of damaged threads was only determined after the studs were removed from the flange stud hole locations. Therefore, for studs that are stuck in place, the staff is concerned that the examinations performed in accordance with the Reactor Head Closure Stud Bolting Program, may not be capable of detecting wear or damage in the stud holes or quantifying the amount of wear or damage in the stud holes.

In addition, the staff also noted that additional RPV flange stud holes may have damaged threads. Specifically, the staff noted that the RPV flange stud hole location Nos. 2, 4, 5, 7, 9, 14, 18, 20, 25, 39, 53, and 54 have or may have missing or damaged threads. This represents more than 20 percent of the applicant’s total number of RPV closure stud bolting. Based on the staff’s review of the documents associated with the applicant’s operating experience, the staff was unable to verify whether the entire RPV

flange assembly was re-assessed every time a new RPV stud or stud hole issue arose, or whether the evaluation of the entire flange assembly had accounted for the collective impact of both the current issue and the past flange issues that occurred before the new occurrences. Thus, the staff is uncertain how “monitoring and trending” is accomplished at the site with respect to this AMP.

During the audit of the “operating experience” program element, as discussed above, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. To obtain the information necessary to determine if the applicant’s operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing RAIs for the subjects discussed above related to operating experience.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that the LRA program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” and “acceptance criteria” are consistent with the corresponding elements of the GALL Report AMP XI.M3. The staff also identified certain aspects of LRA program elements “detection of aging effects” and “monitoring and trending” that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also identified that additional information on operating experience is required before a determination can be made about the sufficiency of the LRA AMP to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.4, Boric Acid Corrosion

Summary of Information in the Application. The LRA states that AMP B2.1.4, “Boric Acid Corrosion,” is an existing program with enhancements that is consistent with the program elements in GALL Report AMP XI.M10, “Boric Acid Corrosion.” To verify this claim of consistency, the staff audited the LRA AMP. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “corrosive,” “cracking,” “degradation,” “rust,” “boric,” and “borated.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.4-Rev 3	Callaway Plant Aging Management Program Evaluation Report, Boric Acid Corrosion – B2.1.4	Revision 3
2. EDP-ZZ-01004	Boric Acid Corrosion Control Program	Revision 011
3. EDP-ZZ-001131	Engineering System Walkdowns, Appendix K	Revision 001
4. MDP-ZZ-LM001	Fluid Management Program	Revision 010
5. CQP-ZZ-05048	Boric Acid Walkdown for RCS Pressure Boundary	Revision 007
6. ODP-ZZ-00029	RCS Leakage Action Level Guideline	Revision 003
7. NET 12-002	Boric Acid Corrosion Control Program (BACCP) Quarterly Report	01/10/2012
8. NET 12-023	Boric Acid Corrosion Control Program (BACCP) Quarterly Report	04/10/2012
9. CAR 200809886	Leak Identified on Line BG-026-BCB-2”	09/26/2008

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program as modified by the proposed enhancements.

During the audit, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that the LRA program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.M10.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.5, Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components

Summary of Information in the Application. The LRA states that AMP B2.1.5, “Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor

Coolant Pressure Boundary Components,” is an existing program that is consistent with the program elements in GALL Report AMP XI.M11B, “Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components [pressurized water reactors (PWRs) only].” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant’s operating experience database using the keywords: “nozzle,” “weld,” “vessel head,” “crack,” “cladding,” and “PWSCC.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.5-Rev 3	Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components (PWRs Only) – B2.1.5 NUREG 1801 Program XI.M11B	Revision 3, 04/12/2012
2. Not applicable	Callaway Plant License Renewal Management Industry Operating Experience Report for AMP XI.M11, “Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components (PWR Only)” B2.1.5	02/29/2012
3. EDP-ZZ-04070	Management of Engineering Materials Degradation Management Plan Subprograms Activities (including Appendix A, Alloy 600 Management Plan)	Revision 4
4. EDP-ZZ-01003	Inservice Inspection Program	Revision 25
5. QCP-ZZ-05048	Boric Acid Walkdown for RCS Pressure Boundary	Revision 7
6. QCP-ZZ-05049	RPV Head Bare Metal Examination	Revision 3
7. CAR 201005998	What Has Changed To Eliminate the Upper Core Flow Anomaly?	07/19/2010
8. CAR 200403580	Loop C Cold Leg Stainless Steel Safe End-to-Pipe Weld Indications	04/30/2004
9. CAR 200609622	Evaluate Pressurizer Weld Overlay and Pressurizer Heater Inspection OE	07/25/2007
10. CAR 200706976	OE25024 – PT Indications Discovered at CRDM Penetration 68	11/21/2006
11. CAR 200703900	Indication Visually Detected in the Reactor Vessel Lower Head Cladding	04/14/2007
12. CAR 200700110	Primary System Integrity Review Visit RV Lower Head Cleaning	01/5/2007
13. CAR 200711361	Incomplete Evaluation for Chemical Conditions	11/30/2007
14. CALC. No. BB-183, Rev. 01	Evaluation of Reactor Vessel Cladding Indication Inside Bottom Head During Refueling 13	1/21/2004

Document	Title	Revision/Date
15. Not applicable	Callaway Nuclear Power Plant Third Interval Inservice Inspection Program Plan Appendix D, Third Interval Examination Schedule	Revision 4, 10/14/2011
16. WCAP-13778	Analysis of Thermal Effects on Component Fatigue Resulting from the Upper Plenum Anomaly in Westinghouse PWRs	November 1993

During the audit of program elements 1–6, the staff verified that the “scope of program,” “preventive actions,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. For the “parameters monitored or inspected” program element, insufficient information was available to determine if it was consistent with the corresponding program element of the GALL Report AMP. To obtain the information necessary to verify if this program element is consistent with the corresponding program element of the GALL Report AMP, the staff will consider issuing RAIs for the subjects discussed below.

The “parameters monitored or inspected” program element of the LRA AMP, as described in the applicant’s evaluation report, indicates that reactor coolant pressure boundary (RCPB) cracking and leakage are monitored by the applicant’s ISI program as augmented by ASME Code Cases N-722-1, N-729-1, and N-770-1, subject to the conditions specified in Title 10 of the *Code of Federal Regulations* (CFR) Part 50.55a, “Codes and standards.” The GALL Report AMP recommends that RCPB cracking and leakage are monitored by the applicant’s ISI program in accordance with 10 CFR 50.55a. ASME Code Case N-770-1 specifies visual examination to detect the reactor coolant leakage and boric acid corrosion associated with Class 1 pressure retaining dissimilar metal piping and vessel nozzle welds. During the audit, the staff noted that the applicant’s procedure for boric acid walkdown and examination scheduled for the third-interval ISI program plan do not clearly indicate the implementation of visual examination specified in ASME Code Case N-770-1.

During the audit, the staff noted that the applicant’s operating experience indicates that refueling cavity seal leakage caused a potential to interfere with the visual examinations of dissimilar metal welds on the reactor vessel loop nozzles and bottom-mounted instrument penetrations. The staff needs to clarify what corrective action was taken to prevent the refueling cavity seal leakage, and to correct the conditions (e.g., corrosion product build-up) that would potentially interfere with the visual examination of dissimilar metal welds on the reactor vessel loop nozzles and bottom-mounted instrument penetrations. The applicant’s implementing procedure for boric acid walkdown for the reactor coolant system does not clearly address how the applicant’s procedure would resolve the instance when leakage from other locations interferes with the visual examinations of the reactor vessel nozzle welds and other RCPB components specified in ASME Code Cases N-770-1 and N-722-1.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. To obtain the information necessary to determine if the applicant’s operating experience supports the

sufficiency of the LRA AMP, the staff will consider issuing RAIs for the subjects discussed below.

During the audit, the staff noted that the applicant's operating experience indicates that the reactor coolant system has experienced reactor hot leg temperature fluctuations associated with periodic, opposing step changes in adjacent hot leg temperatures. This phenomenon has been referred to as "upper plenum anomaly (UPA)," and is apparently caused by a flow switching phenomenon in the reactor vessel upper plenum, as discussed in WCAP-13778, "Analysis of Thermal Effects on Component Fatigue Resulting from the Upper Plenum Anomaly in Westinghouse PWRs," dated November 1993. The UPA may increase the local temperatures of the reactor hot leg nozzles above 625 °F (329 °C) due to non-symmetrical flow mixing such that Inspection Item A-1, rather than A-2, of ASME Code Case N-770-1 should be applied to the inspections of the applicant's reactor hot leg nozzles. It is not clear to the staff how the applicant's program evaluates the potential effect of the UPA on the reactor hot leg nozzle temperatures and determines which inspection item to apply (that is, Inspection Item A-1 or A-2).

LRA Section B2.1.5 also addresses the operating experience regarding the RPV lower head cladding as follows:

An indication was visually detected in the RPV lower head cladding in 2007, during the remote VT-3 examination of the vessel interior. The indication was evaluated and additional volumetric and surface examinations were performed for better characterization. The operating experience also indicates that the indication was determined to be acceptable as is.

During the audit, the staff noted that the applicant's RPV bottom head region has at least two indications of cladding degradation [detected in refueling outages (RFOs) 13 and 15, respectively], as also addressed in LRA Section 4.7.3. The staff needs to confirm the total number of RPV cladding degradation indications detected on the applicant's reactor vessel. In addition, the staff noted that the LRA does not provide the following information on the cladding and vessel degradation: (1) the root cause analysis and corrective action for the cladding indications, (2) the previous inspection results to identify any change in the size and depth of the cladding indications, and (3) the inspection method and frequency to manage the degradation of the cladding and RPV and the technical basis for the adequacy of the inspection method and frequency.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that the LRA program elements "scope of program," "preventive actions," "detection of aging effects," "monitoring and trending," and "acceptance criteria" are consistent with the corresponding program elements in GALL Report AMP XI.M11B. The staff also identified certain aspects of LRA program element "parameters monitored or inspected" that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also identified that additional information on operating experience is required before a determination can be made about the sufficiency of the LRA AMP to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.6, PWR Vessel Internals

Summary of Information in the Application. The LRA states that AMP B2.1.6, “PWR Vessel Internals,” is a new program that is consistent with the program elements in GALL Report AMP XI.M16A, “PWR Vessel Internals.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant’s operating experience database using the keywords: “cracking,” “SCC,” “loss of preload,” and “loss of material.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.6	Callaway Plant Program Evaluation Report B2.1.6	Revision 2
2. CW-SCO-BBVI	Reactor Vessel & Internals: Callaway System and Structure Scoping Report	Revision 1
3. MP 02-1024	Replace Guide Tube Support Pins from the Upper Internals and Replace with a Different Design/Material Pin	Revision A
4. RVIAMD E170.0002/R071	Reactor Vessel Internals Aging Management Document	Revision 0, December 2011
5. LTR-RIDA-12-59	Callaway Unit 1 – Request for Reactor Vessel Internals Material Certifications	03/13/2012
6. CAR 200904268	MRP-227 Implementation Program for Reactor Internals Inspection	Revision 1

During the audit of program elements 1–6, the staff verified that the “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. For the “scope of program” program element, insufficient information was available to determine if it was consistent with the corresponding program elements of the GALL Report AMP. To obtain the information necessary to verify if this program element is consistent with the corresponding program element of the GALL Report AMP, the staff will consider issuing RAIs for the subjects discussed below.

The Callaway reactor vessel internals design does not include thermal shield flexures and includes neutron shield panels instead. However, the LRA states fatigue analyses were performed on reactor vessel internals components, including the thermal shield flexures. It is not clear to the staff if Callaway has thermal shield flexures and whether

the neutron shield panels provided the same intended function as the thermal shield flexures.

The “scope of program” program element of the LRA AMP does not include the upper support ring or skirt. However, the GALL Report AMP recommends that the upper support ring or skirt be in scope as an “Existing program” component. It is not clear to the staff if there is another component that performed the intended function of the upper support ring or skirt and how that component will be inspected.

The “scope of program” program element of the LRA AMP includes a list of components classified as “Existing program” components. The GALL Report AMP recommends that components examined per ASME Code Section XI, Table IWB-2510, B-N-3, be included in the list of “Existing program” components. It is not clear to the staff which “Existing program” components are inspected under Examination Category B-N-3 and if the ISI plan for performing VT-3 examinations will achieve coverage for those reactor vessel internals component locations designated as the B-N-3 components.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

There is currently a draft license renewal interim staff guidance (LR-ISG-2011-04), “Updated Aging Management Criteria for PWR Reactor Vessel Internal Components.” Since the LR-ISG is still in draft form and may change, the applicant’s program may also change. Future RAIs are possible to account for changes to LR-ISG-2011-04 and the applicant’s program.

Audit Results. Based on this audit, the staff verified that the LRA program elements “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.M16A. The staff also identified certain aspects of LRA program element “scope of program” that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.7, Flow-Accelerated Corrosion

Summary of Information in the Application. The LRA states that AMP B2.1.7, “Flow-Accelerated Corrosion,” is an existing program that is consistent with the program elements in GALL Report

AMP XI.M17, “Flow-Accelerated Corrosion.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant’s operating experience database using the keywords: “flow accelerated,” “erosion,” and “flow assist.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.7	Callaway Plant Aging Management Program Evaluation Report, Flow-Accelerated Corrosion	Revision 4, 11/28/2011
2. EDP-ZZ-01115	Flow-Accelerated Corrosion [FAC] of Piping and Components Predictive Performance Manual	Revision 23
3. ME-004	Engineering Design Guide - Material Selection	Revision 1, 12/12/2000
4. ME-013	Pipe Wall Thickness	Revision 1, 09/17/2007
5. 4501-01	Callaway Nuclear Plant FAC System Susceptibility Evaluation	Revision 0 02/08/2008
6. 4501-02	Callaway Nuclear Plant FAC Susceptible Non-Modeled Program	Revision 0, 02/13/2008
7. CAR 200102270	Main Feedwater System Component Wall Thinning	04/22/2001
8. CAR 200403322	RF 13 FAC Results in the Main Feedwater System	04/24/2004
9. CAR 200500411	Unexpected Lowering of Flow during Startup	01/22/2005
10. CAR 200811208	TAF03A Inlet Nozzle Thinning	10/28/2008
11. CAR 201004190	Valve Found with Internal Erosion	05/10/2010
12. FMWE v2.0	FAC Manager Web Edition User Guide	Revision 0, 06/01/2010
13. NET 11-0104	Flow Accelerated Corrosion Refuel 18 Outage Report	11/21/2011
14. NET 10-0026	Refuel 17 Flow Accelerated Corrosion Report	05/15/ 2010
15. DTI-E-00004	Flow-Accelerated Corrosion Program Desktop Instruction	Revision 1, 08/27/2009
16. ULNRC-1591	Callaway Plant Response to I&E Bulletin 87-01, Thinning of Pipe Wall in Nuclear Power Plants	09/10/1987

During the audit of program elements 1–6, the staff verified that the “preventive actions,” “parameters monitored or inspected,” and “monitoring and trending” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. For the “scope of program,” “detection of aging effects,” and “acceptance criteria” program elements, insufficient information was available to determine if they were consistent with the corresponding program elements of the GALL Report AMP. To obtain the information necessary to verify if these program elements are consistent with the corresponding program

elements of the GALL Report AMP, the staff will consider issuing RAIs for the subjects discussed below.

LRA Table 3.3.2-10, "Auxiliary Systems – Summary of Aging Management Evaluation – Chemical and Volume Control System," includes an item for carbon steel piping that is being managed for wall thinning by the Flow-Accelerated Corrosion program. However, Appendix A of the System Susceptibility Evaluation for the Flow-Accelerated Corrosion program states that the chemical and volume control system (BG) is excluded from the Flow-Accelerated Corrosion program based on non-susceptible material. It is not clear to the staff whether the LRA is crediting the Flow-Accelerated Corrosion program for managing portions of a system that has been excluded from the Flow-Accelerated Corrosion program in the System Susceptibility Evaluation, or whether the system has susceptible material that was not evaluated in the System Susceptibility Evaluation.

The LRA AMP description states that the program uses baseline and follow-up inspections using ultrasonic, visual, or other approved testing techniques capable of detecting wall thinning. In the "detection of aging effects" program element, the GALL Report AMP recommends ultrasonic or radiographic testing to detect wall thinning, but does not discuss visual inspections. Since visual inspections were not further described in the Callaway Plant AMP Evaluation Report or in the implementing procedures for this program, it is not clear to the staff whether the applicant uses visual inspections instead of ultrasonic or radiographic testing to detect wall thinning.

The LRA AMP description states that the "[Flow-Accelerated Corrosion (FAC)] Manager Web Edition" is used to calculate component wear, wear rate, and the next scheduled inspection. In the "acceptance criteria" program element, the GALL Report AMP states that inspection results are input for a predictive code to calculate the number of operating cycles remaining before the component reaches the minimum allowable wall thickness. Industry guidance, NSAC-202L, states that, to account for wear rate inaccuracies when calculating remaining service life, the minimum safety factor should never be less than 1.1. The Flow-Accelerated Corrosion program implementing procedure, EDP-ZZ-01115, uses a safety factor of 1.1 in calculating an "Inspection Index" for some situations, but it is not clear to the staff whether a safety factor of 1.1 is used in all situations, and whether any safety factor is used in calculating the next scheduled inspection within FAC Manager Web Edition.

During the audit of the "operating experience" program element, the staff determined that the operating experience provided by the applicant and identified by the staff's independent database search is not bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff's independent database search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. To obtain the information necessary to determine if the applicant's operating experience supports the sufficiency of the LR AMP, the staff will consider issuing RAIs for the subjects discussed below.

The Callaway Plant AMP Evaluation Report included a Callaway Action Request (CAR) that cited "loss of material due to erosion" as an aging effect addressed by this AMP. In addition, CAR 200102270, which was discussed in the above Operating Experience

Report, contained a corrective action to prevent recurrence for wall thinning in main feedwater components, stating, "expanded the scope of wall thinning inspections to include other potential damage mechanisms (impingement, cavitation, etc.). Further, CAR 201004190 discussed valve with internal erosion and "adjacent pipe wall erosion." It was not clear to the staff whether mechanisms other than FAC were being managed in this program.

CAR 20043322 states that for component AE05-AB590, "this calculation decreased the design minimum thickness required by utilizing the measured ultimate tensile strength listed in the Certified Materials Test Report (CMTR). In justifying the use of CMTR data in the calculation of the minimum wall thickness, the applicant provided Engineering Design Guide, ME013, "Pipe Wall Thickness," which stated that it is permissible to use CMTR data instead of published allowable stress values. However, the use of CMTR data to decrease the minimum wall thickness is not consistent with the staff's understanding of the ASME Code.

CAR 200500411 described the failure of a flow tube due to FAC that separated from its venturi throat, migrated downstream, and blocked the minimum recirculation flow. The spool piece containing the flow venturi had been inspected in 2004 and was projected to last more than 50 years; however, the configuration of the flow element does not allow it to be inspected from the outside of the pipe using ultrasonic testing methods. While the wall thinning due to FAC is not unique, this circumstance is unique because normal wall thinning inspections cannot be used to monitor ongoing wall thinning of a passive component. Furthermore, the consequence of FAC resulted in macrofouling, and this plant-specific operating experience is not bounded by the industry operating experience for which the GALL Report program was evaluated.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR supplement was an adequate description of the LRA AMP. To obtain the information necessary to verify the sufficiency of the FSAR supplement program description, the staff will consider issuing RAIs for the subject discussed below.

The FSAR supplement states that inspections are performed using ultrasonic, visual, or other approved testing techniques capable of detecting wall thinning; however, it is not clear to the staff that visual inspections alone are capable of detecting wall thinning. This issue can be included with the RAI for the "detection of aging effects" program element discussed above.

Audit Results. Based on this audit, the staff verified that the LRA program elements "preventive actions," "parameters monitored or inspected," and "monitoring and trending" are consistent with the corresponding program elements in GALL Report AMP XI.M17. The staff also identified certain aspects of LRA program elements "scope of program," "detection of aging effects," and "acceptance criteria" that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also identified that additional information on operating experience is required before a determination can be made about the sufficiency of the LRA AMP to detect

and manage the effects of aging. In addition, the staff identified a need for additional information regarding the adequacy of the program description in the FSAR supplement.

LRA AMP B2.1.8, Bolting Integrity

Summary of Information in the Application. The LRA states that AMP B2.1.8, “Bolting Integrity,” is an existing program with enhancements that is consistent with the program elements in GALL Report AMP XI.M18, “Bolting Integrity.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency, these will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted a walkdown of the “B” Emergency Diesel Generator room. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “bolt,” “torque,” “preload,” “crack,” “SCC,” “leak,” “flange,” “lubrication,” and “moly.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.8	Bolting Integrity	Revision 3, 04/12/2012
2. APA-ZZ-00500	Corrective Action Program	Revision 54
3. APA-ZZ-00400	Procurement of Parts, Supplies, Materials, and Services	Revision 37
4. APA-ZZ-00662	ASME Section XI Repair/Replacement Program	Revision 20
5. Not applicable	Callaway Plant Bolting Manual	Revision 8, 03/27/2012
6. E170.0105	Callaway Nuclear Power Plant Third Interval Inservice Inspection Program Plan	Revision 5, 10/19/2011
7. EDP-ZZ-01003	Inservice Inspection Program	Revision 25
8. EDP-ZZ-01131	Plant Health and Performance Monitoring Program	Revision 21
9. EDP-ZZ-01131	Appendix K, Engineering System Walkdowns	Revision 1
10. MDP-ZZ-LM001	Fluid Leak Management Program	Revision 11
11. MDP-ZZ-LR001	Temporary Repair of Leaks	Revision 3
12. CAR 201102260	Determine If Callaway Procedures Fulfill Recommendations of GL 91-17	03/22/2011
13. QCP-ZZ-05018	Ultrasonic Examination of Bolting	Revision 6
14. CAR 200703805	Damaged Stuck Studs	04/12/2007
15. CAR 200703822	Damaged Stuck Studs	04/13/2007
16. CAR 200703691	Damaged Stuck Studs	04/11/2007
17. CAR 200906224	Remove Stuck Studs	08/09/2009
18. CAR 200001317	Missing Torque Values in Work Package	06/02/2000
19. CAR 200002198	Missing Torque Values in Work Package	09/10/2000
20. CAR 200403325	Overtorqued Studs	04/24/2004

Document	Title	Revision/Date
21. CAR 200810176	Wrong Bolt Material	10/07/2008

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program as modified by the proposed enhancements.

During the audit, the staff verified that the “scope of program,” “preventive actions,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. In addition, the staff found that for the “parameters monitored or inspected” program element, sufficient information was not available to determine if it was consistent with the corresponding program elements of the GALL Report AMP. To obtain the information necessary to verify if this program element is consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing an RAI for the subject discussed below.

The “parameters monitored or inspected” program element of the GALL Report AMP states that the program monitors the effects of aging on the intended function of bolting, and that components should be inspected for leakage, loss of material, cracking, and loss of preload. However, between 1985 and 1987, Callaway installed seal cap enclosures on four swing check valves to mitigate gasket leakage from the bolted body-to-bonnet flange joint. The use of seal cap enclosures as mitigation for leakage may prevent the bolting within the enclosure from being managed for loss of preload, cracking, and loss of material aging effects since the enclosure prevents direct inspection of the bolted joint. The known seal cap enclosures have since been removed; however, it is not clear to the staff whether additional seal cap enclosures have been installed or if seal cap enclosures are still used at the site to mitigate leakage. Furthermore, the staff requested clarification on how the use of seal cap enclosures is controlled such that aging effects can be managed in the period of extended operation.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “preventive actions,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.M18. The staff also identified certain aspects of LRA program element “parameters monitored or inspected” that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the

effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.9, Steam Generators

Summary of Information in the Application. The LRA states that AMP B2.1.9, “Steam Generators,” is an existing program that is consistent with the program elements in GALL Report AMP X1.M19, “Steam Generators.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant’s operating experience database using the keywords: “steam generator,” “tube,” “leakage,” and “eddy current.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.9	Steam Generators	Revision 5
2. APA-ZZ-00801	Foreign Material Exclusion	Revision 031
3. APA-ZZ-01023	Primary-to-Secondary Leakage Program	Revision 019
4. EDP-BB-01341	Steam Generator Surveillance	Revision 006
5. ETP-BB-01314	Steam Generator Secondary Upper Internals Inspection	Revision 004
6. ETP-BB-01315	Secondary Side Inspection Plan and Procedure	Revision 008
7. S-1032	Technical Specification [(TS)] for Steam Generator Maintenance Services	Revision 12
8. ETP-AE-03000	Upper Bundle Flush and Water (Sludge) Lancing	Revision 010
9. ETP-BB-01309	Steam Generator Eddy Current Testing and Analysis Guidelines	Revision 022
10. AREVA NP 51-9172264-000	Callaway Unit-1 SG [Steam Generator] Condition Monitoring for Cycles 16, 17, and 18 and Final Operational Assessment for Cycles 19, 20, and 21.	10/18/2010
11. AREVA 51-9034988-000	Callaway EOC [End-of-Cycle] 15 Steam Generator Degradation Assessment	03/20/2007
12. AREVA NP 51-9167781-000	Callaway 1R18 Degradation Assessment October 2011	10/18/2010
13. AREVA 51-9048595-000	Condition Monitoring an Operational Assessment for Callaway (EOC-15)	03/30/2006

During the audit of program elements 1–6, the staff verified that the “scope of program” program element of the LRA AMP is consistent with the corresponding element of the GALL Report AMP. For the “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements, insufficient information was available to determine if they were consistent with the corresponding program elements of the GALL Report AMP. To obtain the information necessary to verify if these

program elements are consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing RAls for the subjects discussed below.

The “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP state, in general, that Nuclear Energy Institute (NEI) 97-06, “Steam Generator Program Guidelines,” and the associated Electric Power Research Institute (EPRI) guidelines will be followed for the steam generator AMP. The GALL Report AMP indicates that the NEI 97-06 program and the associated EPRI guidelines have been effective at ensuring steam generator integrity. It is not clear to the staff that the applicant’s program is consistent with NEI 97-06 and the associated EPRI guidelines since several apparent discrepancies were identified as discussed below.

NEI 97-06, “Steam Generator Program Guidelines,” Revision 3, was to be implemented by September 1, 2011. The Technical Specification (TS) for Steam Generator Maintenance Services (S-1032) was used for the RFO 18 steam generator tube inspections (which began after October 15, 2011). This document (S-1032) references NEI 97-06, Revision 2, in Section 4.2.A.4. If NEI 97-06, Revision 2, was used it would not be consistent with the industry program and a deviation should have been processed per NEI 03-08. This information could not be located by the staff.

The term “active” degradation is used in EDP-BB-01341, “Steam Generator Surveillance” (e.g., refer to Sections 4.4.1.4, 4.9.7.c, and 7.1). This term, as originally defined, was misleading and is no longer used in the Pressurized Water Reactor Steam Generator Examination Guidelines, which were issued in 2007. The use of the term “active” degradation appears to be inconsistent with industry guidelines.

Section 4.1.2.c.3 of EDP-BB-01341, “Steam Generator Surveillance,” indicates that if implementation of a guideline change cannot be performed within 3 months of the due date then a deviation should be processed. This appears to permit implementing the guideline change 3 months after the due date. It is not clear that this 3-month “extension” is permitted by the industry guidelines (i.e., if the forwarding letter indicates the guideline change should be implemented by a specific date, it is not clear that a 3-month automatic extension is justified).

Section 4.5.1 of EDP-BB-01341, “Steam Generator Surveillance,” deals with secondary side inspections; however, Section 4.5.1.a refers to primary side maintenance activities. This appears to be a typographical error; however, it may result in the procedures being inconsistent with the EPRI guidelines.

Section 4.10.3 of EDP-BB-01341, “Steam Generator Surveillance,” requires the condition monitoring report to be completed within 30 days following completion of the outage; however, Section 4.9.6.a.1 requires the condition monitoring report to be completed prior to Mode 4 after a steam generator inspection. The EPRI Steam Generator Integrity Assessment Guidelines (Section 1.2.2) requires the condition monitoring assessment to be completed before Mode 4. There appears to be an internal discrepancy on the requirement pertaining to completion of the condition monitoring report that draws into question whether the industry guidelines are being followed.

Section 4.8.5.e of EDP-BB-01341, "Steam Generator Surveillance," refers to "degradation of interest" rather than "existing and potential degradation" as discussed in the EPRI Steam Generator Integrity Assessment Guidelines (Section 6.2). A definition of "degradation of interest" could not be located in the procedure to permit confirmation that this procedure is consistent with industry guidelines.

AREVA NP, Inc. Document No. 51-9172264-000, "Callaway Unit-1 SG [Steam Generator] Condition Monitoring for Cycles 16, 17, and 18 and Final Operational Assessment for Cycles 19, 20, and 21," does not appear to justify the length of the operating interval for secondary side degradation. Section 10.3 of the EPRI Steam Generator Integrity Assessment Guidelines indicates that the operational assessment shall include a justification for operating the planned interval between secondary side inspections as well as primary side inspections. If a justification to operate for the planned operating interval is not performed for secondary side degradation, it would be inconsistent with industry guidelines.

Section 8.6 of the EPRI Steam Generator Integrity Assessment Guidelines indicates, in part, that (1) failure to meet condition monitoring requirements means that the projections of the previous operational assessment were not conservative and that necessary corrective actions shall be identified, and (2) even if condition monitoring requirements are met, a comparison of condition monitoring results with the projections of the previous operational assessment shall be performed and that this comparison shall be completed prior to issuance of the final operational assessment since adjustment of input parameters may be required.

In AREVA NP, Inc. Document No. 51-9172264-000, "Callaway Unit-1 SG [Steam Generator] Condition Monitoring for Cycles 16, 17, and 18 and Final Operational Assessment for Cycles 19, 20, and 21," there is a statement that the latter must be performed, but then the report went on to indicate that the assumptions and uncertainties included in the previous operational assessment are validated since none of the detected indications approach the condition monitoring limit and that additional discussions below provide further details. The staff could not locate these additional discussions. In addition, in reviewing the previous operational assessment, the staff could not locate any specific projections such that a comparison of the as-found and previously projected conditions could be compared. It is not clear that the intent of the EPRI requirement has been met. The staff notes that the operational assessment is supposed to be conservative. As a result, even if the actual detected conditions are near (including "slightly" below) the projections from the previous operational assessment, this could indicate a potential nonconservative assessment that may lead to issues in the future, if not corrected.

During the audit of the "operating experience" program element, the staff determined that the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff's independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the LRA FSAR supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR supplement was an adequate description of the LRA AMP. To obtain the information necessary to verify the sufficiency of the FSAR supplement program description, the staff will consider issuing RAIs for the subject discussed below.

The FSAR supplement for steam generators (LRA Section A1.9) indicates that the tube structural integrity limits consistent with Regulatory Guide (RG) 1.121, "Bases for Plugging Degraded PWR [Pressurized Water Reactor] Steam Generator Tubes," are applied. The structural integrity requirements for steam generator tubes are specified in the plant's TSs. Although RG 1.121 provides guidance and a methodology for determining steam generator tube plugging limits, the actual requirements for tube integrity are contained in the plant's TSs. It would appear more complete to indicate that structural limits consistent with the steam generator structural integrity performance criteria (specified in the plant technical specifications) are applied.

Audit Results. Based on this audit, the staff verified that the LRA program element "scope of program" is consistent with the corresponding program element in GALL Report AMP X1.M19. The staff also identified certain aspects of LRA program elements "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff identified a need for additional information regarding the adequacy of the program description in the FSAR supplement.

LRA AMP B2.1.10, Open-Cycle Cooling Water System

Summary of Information in the Application. The LRA states that AMP B2.1.10, "Open-Cycle Cooling Water System," is an existing program with an enhancement that is consistent with the program elements in GALL Report AMP XI.M20, "Open-Cycle Cooling Water System." To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER. The scope of this audit report includes an enhancement necessary to make the LRA AMP consistent with the corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted partial walkdowns of the ultimate heat sink cooling tower and the essential service water pump house. The staff also conducted an independent search of the applicant's operating experience database using keywords: "coating," "erosion," "fouling," "microbiological," "service water," and "through wall."

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff's search of the applicant's operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.10	Callaway Plant Aging Management Program Evaluation Report, Open-Cycle Cooling Water System	Revision 3, 04/08/2012
2. ULNRC-2146	Callaway Plant Response to Generic Letter 89-13, Service Water System Problems Affecting Safety Related Equipment	01/29/1990
3. ULNRC-05425	Callaway Plant Cycle 15 Commitment Change Summary Report	07/16/2007
4. EDP-ZZ-01121	Raw Water Systems Predictive Performance Program	Revision 14
5. EDP-ZZ-01112	Heat Exchanger Predictive Performance Manual	Revision 17
6. ETP-ZZ-03001	GL 89-13 Heat Exchanger Inspection	Revision 9
7. APA-ZZ-01025	Raw Water Systems Control Program	Revision 0
8. CAR200608086	ESW Pipe Preservation	10/01/2006
9. CAR200700441	New Commitments to GL 89-13	01/17/2007
10. CAR200703627	ISP-SA-2413A/B Procedure Revision in 1993 Causing ESW System Transient	04/10/2007
11. CAR200703680	Flange on EF-007-HB-30" to EFV113 Has Corrosion Damage	04/11/2007
12. CAR200703776	PEF01B Potential Erosion Damage on Pump Discharge	04/12/2007
13. CAR200800415	Service Water System Components with MIC Index Greater Than 50	01/17/2008

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program as modified by the proposed enhancements.

During the audit, the staff verified that the “scope of program,” “preventive actions,” and “monitoring and trending,” program elements of the LRA AMP are consistent with the corresponding element of the GALL Report AMP. In addition, the staff found that for the “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria,” program elements sufficient information was not available to determine if they were consistent with the corresponding program elements of the GALL Report AMP. To obtain the information necessary to verify if these program elements are consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing RAls for the subjects discussed below.

GALL AMP XI.M20, “detection of aging effects,” states that inspection methods (e.g., visual or nondestructive examination) are in accordance with the applicant’s docketed response to Generic Letter (GL) 89-13. Callaway responded to GL 89-13, by letter dated January 29, 1990, and stated that selected sections of ESW piping are inspected each RFO and that “each pipe is radiographed to determine any localized pitting. This is followed by ultrasonic testing using accurately placed grid locations to determine the extent of any damage.” However, the AMP Evaluation Report and the implementing procedure EDP-ZZ-01121 do not describe the use of radiography as part of the program, which appears to be inconsistent with the docketed response to GL 89-13.

GALL AMP XI.M20 program element “detection of aging effects,” states that when sampling is used in condition monitoring programs, the basis for the inspection population and sample size should be provided. However, information provided during the audit did not include the number or selection criteria for the locations being trended by the program. In addition, procedure EDP-ZZ-01121 included an appendix with

“Non-Trended Monitored Locations for Raw Water Program,” but did not describe the identification criteria and purpose of these non-trended locations.

GALL AMP XI.M20 program element “parameters monitored or inspected,” discusses inspections of coatings. However, the AMP Evaluation Report states that the “amount of coating surface area is relatively small and its aging has not been a concern for ESW system performance,” and does not indicate that inspection of coatings are credited as part of this program.

GALL AMP XI.M20, “detection of aging effects,” states that inspection scope is in accordance with the applicant’s docketed response to GL 89-13. Callaway modified its commitments to GL 89-13, by letter dated July 7, 2007, stating that for various room coolers, monitoring methods will be fin inspection and cleaning per EDP-ZZ-01112 and that thermography also will be performed on these heat exchangers as a method of predictive performance monitoring. For the containment air coolers, the letter states that the primary monitoring method will be cleaning and inspection of the outer coil fins per EDP-ZZ-01112. However, EDP-ZZ-01112 did not appear to address inspection or cleaning for room cooler or the containment air cooler fins. In addition, aging management review (AMR) items in LRA Tables 3.3.2-19 and 3.3.2-15 cited heat transfer as an intended function for these air heat exchangers, but does not cite reduction of heat transfer as an aging effect requiring management (AERM).

GALL AMP XI.M20, “acceptance criteria,” states that inspected components should exhibit adequate design margin. During its review of operating experience reports, the staff noted that CAR 200703680 justified the structural integrity of a damaged flange by stating that the “standard Class 3 manufacturing tolerance of 12.5 percent” provides assurance that the corrosion damage on a 30-inch flange is not a structural or pressure boundary issue. However, the staff notes that the 12.5 percent manufacturing tolerance typically only applies to pipe wall thickness and not to flange thickness.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. To obtain the information necessary to determine if the applicant’s operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing RAIs for the subject discussed below.

Due to the pervasive degradation of the ESW system, it was not clear what enhancements were made to the AMP to address the consequences of past program weaknesses. Since additional leaks continue to be identified, it is unclear what specific corrective actions were taken to prevent recurrence of the identified problems, and whether additional replacement activities will be credited for license renewal.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” and “monitoring and trending” are consistent with the corresponding program elements in GALL Report AMP XI.M20. The staff also identified certain aspects of LRA program elements “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” for which additional information or additional evaluation is required before consistency can be determined.

Based on this audit, the staff also identified that additional information about operating experience is required before a determination can be made about the sufficiency of the LRA AMP to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.11, Closed Treated Water Systems

Summary of Information in the Application. The LRA states that AMP B2.1.11, “Closed Treated Water Systems,” is an existing program with enhancements that is consistent with the program elements in GALL Report AMP XI.M21A, “Closed Treated Water Systems.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “corrosive,” “cracking,” “crevice,” “pitting,” “rust,” “fouling,” “biofoul,” “microbiological,” and “wastage.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.11-Rev 2	Callaway Plant Aging Management Program Evaluation Report, Closed Treated Water Systems – B2.21.11	Revision 2
2. CDP-ZZ-00110	Chemistry Data Trending Program	Revision 004
3. CDP-ZZ-00200	Chemistry Schedule and Water Specs	Revision 092
4. CDP-ZZ-00940	Auxiliary Water Systems Chemistry Optimization Plan	Revision 006
5. EDP-ZZ-xxxxx	Non-Chemistry Inspection of Closed Treated Water Systems	Revision 0
6. ETP-EG-00003	Proto-Power Corporation Procedure: Thermal Performance Test of the “A” CCW Heat Exchanger	Revision 0, 10/08/2008
7. ETP-EG-00004	Proto-Power Corporation Procedure: Thermal Performance Test of the “B” CCW Heat Exchanger	Revision 0, 10/08/2008
8. CAR 200900231	Wall Thinning on EDG Heat Exchangers	01/13/2009
9. CAR 200805013	B Diesel Generate Has Pitting on Jacket Water System	06/10/2008

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program as modified by the proposed enhancements.

During the audit, the staff verified that the “scope of program” program element of the LRA AMP is consistent with the corresponding element of the GALL Report AMP. The staff also verified that the “preventive actions” program element of the LRA AMP is consistent with the GALL Report AMP, including the use of water chemistry controls, such as the monitoring of bacteria counts and adding biocides as necessary to inhibit microbiologically-influenced corrosion (as stated in procedure CDP-ZZ-00200). In addition, the staff found that for the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements, sufficient information was not available to determine if they were consistent with the corresponding program elements of the GALL Report AMP. To obtain the information necessary to verify if these program elements are consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing RAIs for the subjects discussed below.

The enhancement associated with the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP states that a representative sample of each combination of material and water treatment program will be visually inspected at least every 10 years. The GALL Report AMP recommends that a representative sample of piping and components be selected based on likelihood of corrosion or cracking and inspected at least every 10 years. In its review of the applicant’s onsite documentation, the staff noted inconsistencies between the LRA enhancement, program basis document, and the implementing procedure regarding the inspection sampling methodology. Because of these inconsistencies, and the fact that inspections may not be focused on locations with the greatest likelihood of corrosion or cracking, it is not clear to the staff whether the inspection sampling methodology is adequate to ensure that degradation can be detected before loss of intended functions.

The program description of the LRA AMP states that the program uses the water treatment of molybdate control with tolyltriazole in the closed treated water systems. During its review of the applicant’s onsite documentation, the staff noted that the boron thermal regeneration system (BTRS) chilled water, a closed treated water system, is treated with a nitrite/molybdate chemistry. The staff also noted that the improper identification of the water chemistry of the BTRS chilled water system may lead to inadequate inspection sampling of unique combinations of materials and water treatment programs. Thus, it is not clear to the staff whether the inspection sampling of this system will be adequate to ensure that degradation can be detected before loss of intended functions.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program” and “preventive actions” are consistent with the corresponding program elements in GALL Report AMP XI.M21A. The staff also identified certain aspects of LRA program elements “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.12, Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems

Summary of Information in the Application. The LRA states that AMP B2.1.12, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems,” is an existing program with enhancements that is consistent with the program elements in GALL Report AMP XI.M23, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted a walkdown of the crane for the “B” Emergency Diesel Generator Room. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “crane,” “hoist,” “scc,” “rail,” “overhead,” and “wear.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.12	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems	Revision 2, 10/18/2010
2. APA-ZZ-00365	Callaway Plant Lifting and Rigging Program	Revision 21
3. APA-ZZ-00365	Addendum L, Callaway Plant Lifting Operations	Revision 9
4. APA-ZZ-00322	Integrated Work Management Process Description	Revision 12
5. MPM-KE-QH008	Polar Crane Inspection	Revision 29
6. APA-ZZ-00500	Corrective Action Program	Revision 54
7. CAR 200908152	Loose Bolts Found on Turbine Crane Safety Bar	09/18/2009

Document	Title	Revision/Date
8. CAR 200900603	Circ & Service Water Pump House Overhead Crane	01/27/2009

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program as modified by the proposed enhancements. During the audit, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff determined that the operating experience the applicant provided and the staff identified in an independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience the applicant provided and the staff identified in an independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.M23.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.13, Fire Protection

Summary of Information in the Application. The LRA states that AMP B2.1.13, “Fire Protection,” is an existing program with enhancements that is consistent with the program elements in GALL Report AMP XI.M26, “Fire Protection.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of the halon system, fire barrier walls, and fire barrier penetrations for the ESF switchgear room. The staff also conducted an independent search of the applicant’s operating experience database using the plant designation for the fire protection system, “KC,” and the keywords “corrosive,” “damage,” and “fire.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff's search of the applicant's operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.13	Callaway Plant Aging Management Program Evaluation Report Fire Protection – B2.1.13	Revision 4
2. CAR 200400717	Seismic Gap Isolation Seal Inadequate	
3. CAR 200408368	Fire Door DSK15031 Will Not Fully Self Close and Latch	
4. CAR 200508469	Degraded Structural Steel Fireproofing in Room 3404	
5. CAR 200608108	NRC Inspection Item: Aux Bldg. Fire Door Integrity	
6. CAR 200901428	Fire/Radiation Barrier Seal Found Degraded	
7. APA-ZZ-00703	Fire Protection Operability Criteria and Surveillance Requirements	Revision 20
8. MSM-ZZ-FG002	Fire Damper Inspection and Drop Test	Revision 12
9. MSM-KC-FQ001	Function Test – Halon Systems Protecting Safety Related Areas	Revision 27
10. MSM-KC-FT001	Halon Fire Protection Cylinder Inspection	Revision 27
11. OSP-KC-00015	Fire Door Inspections	Revision 13
12. QSP-ZZ-65045	Fire Barrier Seal Visual Inspections	Revision 8
13. QSP-ZZ-65046	Fire Barrier Inspection	Revision 13

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program as modified by the proposed enhancements.

During the audit, the staff verified that the “preventive actions,” “parameters monitored or inspected,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. In addition, the staff found that for the “scope of program” and “detection of aging effects” program elements, sufficient information was not available to determine if they were consistent with the corresponding program elements of the GALL Report AMP. To obtain the information necessary to verify if these program elements are consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing RAIs for the subjects discussed below.

The “scope of program” program element of GALL Report AMP XI.M26 includes aging management of penetration seals, walls, ceilings, floors, doors, and other fire resistance materials with a fire barrier function. The LRA denotes items with an intended function of fire barrier using an “FB.” However, there are AMR items in the LRA that have an intended function of fire barrier but are not being managed for aging using the Fire Protection program. It is not clear to the staff how these statements are consistent because some components with a fire barrier function are not being managed for aging using the Fire Protection program.

The “detection of aging effects” program element of GALL Report AMP XI.M26 states that visual inspections of fire barrier penetration seals, walls, ceilings, floors, doors, and other fire barrier materials are performed by fire protection qualified personnel. During the audit, the staff noted that procedures QSP-ZZ-65045, “Fire Barrier Seal Visual

Inspection,” and QSP-ZZ-65046, “Fire Barrier Inspection,” state that the personnel performing the inspections are Quality Control Inspectors. The staff also noted that procedure OSP-KC-00015, “Fire Door Inspections,” does not state what qualifications are required for personnel who perform the inspections. It is not clear to the staff whether these statements are consistent because the personnel who perform inspections as part of the Fire Protection program are not fire protection qualified.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “preventive actions,” “parameters monitored or inspected,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.M26. The staff also identified certain aspects of LRA program elements “scope of program” and “detection of aging effects” that will require additional information or additional evaluation before consistency can be determined.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.14, Fire Water System

Summary of Information in the Application. The LRA states that AMP B2.1.14, “Fire Water System,” is an existing program with enhancements and exceptions that is consistent with the program elements in GALL Report AMP XI.M27, “Fire Water System.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER. This audit report does not consider the sufficiency of exceptions, which will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of the fire water storage tanks, electric and diesel fire water pumps, and jockey pump. The staff also conducted an independent search of the applicant’s operating experience database using the plant designation for the fire protection system, “KC,” and the keywords “corrosive,” “damage,” and “fire.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff's search of the applicant's operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. APA-ZZ-00703	Fire Protection Operability Criteria and Surveillance Requirements	Revision 20
2. CTP-KC-06001	Fire Protection System Chemical Addition	Revision 6
3. MPM-KC-FW004	18 Month Fire Hose Station Inspection Outside Areas	Revision 9
4. MSM-KC-FW007	Yard Loop Flush	Revision 18
5. MSM-KC-FW004	Fire Hose Hydrostatic Testing	Revision 19
6. MSM-KC-FW008	Fire Hose Hydrostatic Testing in Potentially Contaminated Areas	Revision 11
7. MSM-KC-FW003	Fire Hose Station Inspection Inside RCA	Revision 19
8. MSM-KC-FW009	Fire Hose Station Inspection Outside RCA	Revision 7
9. OSP-KC-03003	Fire Main Flow Test	Revision 5
10. OSP-KC-00008	Sprinkler System Discharge Head Inspection	Revision 10
11. APA-ZZ-01025	Raw Water Chemistry Strategic Optimization Plan	Revision 7
12. CAR 200408232	Preliminary Test Data Indicates Fire Loop C Factor Lower than Allowed	
13. CAR 200502420	During Performance of OSP-KC-00009, 10 Nozzles Failed to Meet Acceptance Criteria	
14. CAR 200510105	Jockey Pump Excessive Run Time	
15. CAR 200608082	Fire Protection Piping AFI	
16. CAR 200711546	Underground Fire Protection Leak Downstream of VKC1052	
17. CAR 200801913	Fire Water Leak at Stores 2	
18. CAR 200808087	Engineering Fundamentals AFI	
19. CAR 200809173	Fire Water MIC Samples High from Stagnant Conditions	
20. CAR 200909578	Fire Loop Flow Test Did Not Meet Acceptance Criteria	
21. CAR 201102974	Fire Loop Flow Test Did Not Meet Acceptance Criteria	
22. CAR 201106793	Fire Protection System Hose Testing Job Delays	08/25/2011
23. CAR 201110777	Fire Hose Leak During Training	

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program as modified by the proposed enhancements. Aspects of the “detection of aging effects” program element of the LRA AMP associated with the exception were not evaluated during this audit. Aspects of this program element that are not associated with the exception were evaluated and are described below.

During the audit, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. In addition, the staff found that for the program description and “detection of aging effects” program element, sufficient information was not available to determine if the LRA AMP is consistent with the corresponding GALL Report AMP. To obtain the information necessary to verify if the LRA AMP is consistent with the corresponding GALL Report AMP, the staff will consider issuing RAIs for the subjects discussed below.

The program description of GALL Report AMP XI.M27 recommends that sprinklers that have been in place for 50 years be replaced or a representative sample of sprinklers be field service tested at a recognized testing laboratory in accordance with National Fire Protection Association (NFPA) 25, "Inspection Testing and Maintenance of Water-Based Fire Protection Systems." The LRA states that sprinklers will be replaced prior to 50 years inservice or a representative sample of sprinklers will be tested, with testing repeated every 10 years. The Fire Water System program does not discuss what type of testing will be performed or that testing will be performed in accordance with NFPA 25. It is unclear to the staff whether these statements are consistent because the LRA does not state that testing will be performed in accordance with NFPA 25.

The program description of GALL Report AMP XI.M27 recommends that sprinklers be tested in accordance with applicable NFPA codes and standards. NFPA 25 states that any sprinklers that show signs of physical damage, corrosion, or loading shall be replaced. In the first operating experience example of the "operating experience" program element, the LRA states that in 2005, 10 sprinkler heads were found with corrosion or damage. The LRA also states that two sprinkler heads were replaced and the rest were cleaned. Review of CAR 200502420 during the audit identified that there were four sprinklers with damage, three with corrosion, and three with lint, but only two were documented as being replaced. It is unclear to the staff why only two of the sprinklers with identified damage, corrosion, or loading were replaced. This does not appear to be consistent with the guidance in NFPA 25, and therefore does not appear to be consistent with the recommendations in the GALL Report.

The "detection of aging effects" program element of GALL Report AMP XI.M27 recommends that fire hydrants be flow tested annually in accordance with NFPA 25. The LRA states an exception to GALL Report AMP XI.M27 to perform fire hydrant flow tests every 3 years. The staff reviewed the results of the last three performances of the fire hydrants flow tests. The staff noted that testing performed in 2011 indicated that approximately 25 percent of the hydrants tested failed to drain in the required timeframe. The testing performed in 2007 indicated that approximately 20 percent of the hydrants tested failed to drain properly, and testing performed in 2005 indicated that approximately 50 percent of the hydrants tested failed to drain as required. It is not clear to the staff how the existing frequency of 3 years is acceptable to identify degradation before loss of intended function given that the recent performances of the hydrant flush has resulted in 20–50 percent of the hydrant's failing.

The "detection of aging effects" program element of GALL Report AMP XI.M27 recommends that fire hoses be hydrostatically tested annually in accordance with NFPA codes and standards. The LRA states an exception to GALL Report AMP XI.M27 to perform hydrostatic hose testing for hose stations that are more than 5 years old on a 3-year frequency. During the audit, the staff noted that hydrostatic testing has not been performed since 2007. The staff also noted that CAR 201110777 documents failure of a fire hose when it was charged during fire brigade training in 2011. It is not clear to the staff how these statements are consistent because fire hose hydrostatic testing is not being performed in accordance with the frequency outlined in the existing Fire Protection program or the frequency recommended in GALL Report AMP XI.M26.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. To obtain the information necessary to determine if the applicant’s operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing RAIs for the subject discussed below.

GALL Report AMP XI.M27 manages aging for components exposed to fire water to ensure degradation is detected before loss of intended function. GALL Report AMP XI.M27 includes system flow testing and pipe wall thickness evaluations using non-intrusive techniques or visual inspections to manage aging. The LRA states that flow testing is performed every 3 years and pipe wall thickness examinations or internal inspections will be performed prior to the period of extended operation and every 10 years. The LRA includes an operating experience example, which states that there was a leak in the fire water system in 2005 identified by excessive jockey pump run times. CAR 200510105 clarifies that the leak was on buried piping on an isolable branch. The LRA includes another operating experience example, which states that a low cleanliness factor was identified during system flow testing in 2006. Chemical cleaning was performed on the fire water system to improve the cleanliness factor. However, after chemical cleaning, five leaks developed and were subsequently repaired. During the audit, the staff noted that microbiologically induced corrosion (MIC) contributed to the low cleanliness factor and leakage. Furthermore, subsequent to the chemical cleaning, additional leaks have occurred. The staff also noted that system flow testing performed in 2011 identified a low cleanliness factor again and compensatory measures were required to maintain system intended function. Given that the fire water system degraded from a clean system in 2006 to a degraded system in 2011, in which compensatory measures were required to maintain system intended function, it is not clear to the staff how aging of the fire water system will be adequately managed during the period of extended operation such that loss of intended function of the fire water piping does not occur.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.M27. The staff’s evaluation of aspects of the program element associated with exceptions will be addressed in the SER. The staff also identified certain aspects of the program description and LRA program element “detection of aging effects” that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also identified that additional information about operating experience is required before a determination can be made regarding the sufficiency of the LRA AMP to detect and manage the effects of aging. In addition, the staff verified that the

description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.15, Aboveground Metallic Tanks

Summary of Information in the Application. The LRA states that AMP B2.1.15, “Aboveground Metallic Tanks,” is a new program with exception that will be consistent with the program elements in GALL Report AMP XI.M29, “Aboveground Metallic Tanks.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER. This audit report does not consider the sufficiency of exceptions, which will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of the condensate storage tank (CST), refueling water storage tank (RWST), and fire water storage tanks (FWST). The staff also conducted an independent search of the applicant’s operating experience database using keywords: “coating,” “chloride,” “corrosive,” “cracking,” “damage,” “degradation,” “flaw,” “holiday,” “indication,” “inspection,” “insulation,” “loss of material,” “microbiological,” “pitting,” “sulfate,” and “throughwall.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.15	Callaway Plant Aging Management Program Evaluation Report, Aboveground Metallic Tanks – B2.1.15 NUREG-1801 Program XI.M29	Revision 2, 04/11/2012
2. Not applicable	Callaway Plant Operating Experience Summary Report XI.M29, “Aboveground Metallic Tanks”	03/09/2012
3. EDP-ZZ-xxxxx	Inspections of Aboveground Metallic Tanks	Draft
4. CAR 200000412	Lagging Damage on Top of RWST	None Available
5. CAR 201004307	Small Bubbles in Internal Coating of A Diesel Fuel Oil Storage Tank (EDFOST)	None Available
6. WO 06519798	Work Order - FWST Internal Inspection	09/06/2007
7. WO 08501230	Work Order - FWST Internal Inspection	09/01/2009
8. WO 0951003	Work Order - FWST Internal Inspection	06/27/2011
9. MTT-ZZ-I0011	Installation of Insulation	Revision 8
10. M-160	Specification for Thermal Insulation for Piping and Equipment Located Inside the Reactor Containment and Outside Containment Requiring ISI Examination for the Standardized Nuclear Unit Power Plant System (SNIPPS)	Revision 19
11. M162 B	Specification for Nonmetallic Thermal Insulation for Piping and Equipment Located in the Turbine Building, Auxiliary Boiler Building, and Communications Corridor Building for Union Electric Company	Revision 13

Document	Title	Revision/Date
12. M162 A	Specification for Nonmetallic Thermal Insulation for Piping and Equipment Located in the Auxiliary Building, Control Building, Diesel Generator Building, Fuel Building, and Reactor Waste Building for Union Electric Company	Revision 16

The staff conducted its audit of LRA program elements 1–6, based on the contents of the new program. Aspects of the “detection of aging effects” program element of the LRA AMP associated with the exception were not evaluated during this audit. Aspects of this program element that are not associated with the exception were evaluated and are described below.

During the audit, the staff verified that the “scope of program,” “parameters monitored or inspected,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. In addition, the staff found that for the “preventive actions” and “detection of aging effects” program elements, sufficient information was not available to determine if they were consistent with the corresponding program elements of the GALL Report AMP. To obtain the information necessary to verify if these program elements are consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing RAIs for the subjects discussed below.

The “preventive actions” program element of the LRA AMP states that there are no sealants or caulking applied at the external interface between the bottoms of the CST and RWST and their concrete foundations. The GALL Report AMP recommends that sealant or caulking be applied at the external surface of the interface joint to minimize the amount of water penetrating the interface, which could lead to corrosion of the tank bottom. These statements are not consistent, and the applicant did not identify this as an exception or provide a justification for not meeting the recommendation. Given that this preventive measure is not met, it is not clear to the staff why the number of tank bottom volumetric inspections to be conducted (i.e., one within 5 years of the period of extended operation and whenever the tank is drained) is adequate.

The “preventive actions” program element of the LRA AMP states:

- The stainless steel CST does not have a protective coating; the insulation materials have a documented evaluation demonstrating that there are not any harmful substances which could leach onto the tank surface; and the insulation has a protective aluminum jacket with overlapping seams. In contrast to this statement, LRA Table 3.4.2-6, Insulation, plant-specific note 3, in pertinent part, states, “[t]he dome of the stainless steel tank is prepped with a low halogen (<200 ppm) primer prior to the application of the foam urethane.”
- The stainless steel RWST does not have a protective coating and the insulation has a protective aluminum jacket with overlapping seams.
- The steel FWSTs have an external coating of Carboline tie coat and polyurethane.

The staff has the following concerns and questions:

- The staff lacks sufficient information related to the potential for chemical compounds in the cooling tower water or soil (which could become airborne), if present, to migrate to the tank's external surface and cause cracking, pitting, or crevice corrosion of the stainless steel surface.
- The applicant has not provided information related to whether the insulation on the RWST contains harmful substances that could leach onto the tank surface and cause corrosion.
- The staff questions if coatings are applied on the entire or portions of the CST and RWST external surfaces. In addition, if the coatings are credited for purposes of license renewal, was holiday testing conducted during initial application of the coating, and will the coatings be inspected during the period of extended operation?
- During the staff's walk down of the structure that partially encloses the CST, water stains were observed on the side of the tank where insulation is not installed. It is not clear that insulation jacketing will prevent water intrusion into the tank insulation and then onto the tank surface.

The "detection of aging effects" program element of the LRA AMP states that visual inspections of the exterior surfaces of the CST and RWST are conducted when the surface is accessible. It also states that for inaccessible exterior tank surfaces, the program will sample wall thickness to ensure that the tank bottom and tank wall sections with insulated outer surfaces are not losing material or cracking. It further states that thickness measurements will be conducted once within 5 years of entering the period of extended operation and whenever the tank is drained, and at least one measurement per square yard of tank surface will be performed. The GALL Report AMP recommends that external surfaces of the tank be inspected on a RFO interval. The staff questions whether obtaining one thickness data point per square yard of tank surface is sufficient to detect pitting, crevice corrosion, and cracking. The staff also questions what percent of opportunistically removed insulation would be deemed sufficient to not conduct the internal volumetric exams.

During the audit of the "operating experience" program element, the staff determined that the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff's independent database search is not sufficient to allow the staff to verify that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage the effects of aging. To obtain the information necessary to determine if the applicant's operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing an RAI for the subject discussed below.

Multiple inspections of the internal surfaces of the FWST(s), spanning 2007 through 2011 have revealed blistering and delamination of coatings. Work orders documented that these defects were not all repaired before returning the tanks to service. The work orders document that the acceptance of the as-found defects that were not repaired was based on the fact that internal cathodic protection of the tank would prevent corrosion of

exposed metal surfaces. However, neither the LRA AMP nor FSAR supplement state that the cathodic protection system is credited as a preventive measure to account for the plant-specific operating experience. In addition, the staff lacks sufficient information to conclude that the delaminating coatings would not block downstream components either based on current levels of delamination or those that could occur in the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR supplement was an adequate description of the LRA AMP. To obtain the information necessary to verify the sufficiency of the FSAR supplement program description, the staff will consider issuing an RAI described above associated with the “operating experience” program element.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “parameters monitored or inspected,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.M29. The staff also identified certain aspects of LRA program elements “preventive actions,” and “detection of aging effects,” that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also identified that additional information about operating experience is required before a determination can be made regarding the sufficiency of the LRA AMP to detect and manage the effects of aging. In addition, the staff identified a need for additional information regarding the adequacy of the program description in the FSAR supplement.

LRA AMP B2.1.16, Fuel Oil Chemistry

Summary of Information in the Application. The LRA states that AMP B2.1.16, “Fuel Oil Chemistry,” is an existing program with enhancements that is consistent with the program elements in GALL Report AMP XI.M30, “Fuel Oil Chemistry.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of the emergency fuel oil system storage tanks and the emergency fuel oil system day tanks. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “fuel oil,” “corrosion,” “tank,” “biofoul,” “MIC,” and “emergency diesel fuel.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CSP-ZZ-07350	Diesel Fuel Oil Testing Program	Revision 023
2. CTP-JE-01230	Diesel Fuel Oil Sampling	Revision 043
3. CTP-ZZ-02135	Specific Gravity Determination	Revision 014
4. CTP-ZZ-02145	Flash Point Determination	Revision 010
5. CTP-ZZ-02233	Biodiesel Determination	Revision 000
6. CTP-ZZ-02360	Water and Sediment Determination	Revision 008
7. CTP-ZZ-02350	Viscosity Determination	Revision 009
8. CTP-JE-01235	Diesel Fuel Oil Skid Sampling and Chemical Addition	Revision 005
9. EDP-ZZ-01131 Appendix G	System and Component Health Reports	Revision 005
10. MSM-KJ-QT001	10 Year Emergency Diesel Generator Fuel Oil Storage Tank Cleaning	Revision 011
11. OTS-JE-00002	Filtration of Emergency D/G Fuel Oil	Revision 009
12. 201103756	Callaway Action Request	05/05/2011
13. 200000677	Callaway Action Request	03/29/2000
14. 201004307	Callaway Action Request	05/06/2010
15. 200900683	Callaway Action Request	01/28/2009
16. 199901705	Callaway Action Request	08/22/1999

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program as modified by the proposed enhancements.

During the audit, the staff verified that the “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. In addition, the staff found that for the “preventive actions” program element sufficient information was not available to determine if it was consistent with the corresponding program element of the GALL Report AMP. To obtain the information necessary to verify if this program element is consistent with the corresponding program element of the GALL Report AMP, the staff will consider issuing an RAI for the subject discussed below.

The “preventive actions” program element of the LRA AMP does not state that the diesel fire pump fuel oil day tank and the security diesel generator fuel oil day tank will be periodically cleaned during the period of extended operation. The GALL Report AMP recommends periodic cleaning of a tank that contains diesel fuel oil to allow the removal of sediments.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. To obtain the information necessary to determine if the applicant’s operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing an RAI for the subject discussed below.

The applicant provided operational experience that observed blisters in the coating of an emergency fuel oil system storage tank. The staff will request that the applicant provide an evaluation estimating the corrosion rate of the fuel oil system storage tank should one of the blisters open up, exposing the fuel oil in the tank to the bare metal material of the tank. Additionally, the staff will request the applicant to provide an evaluation of the adequacy of the 10-year inspection interval based on the evaluation of the corrosion rate of the metal of the tank.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.M30. The staff also identified certain aspects of LRA program element “preventive actions” that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also identified that additional information about operating experience is required before a determination can be made about the sufficiency of the LRA AMP to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.17, Reactor Vessel Surveillance

Summary of Information in the Application. The LRA states that AMP B2.1.17, “Reactor Vessel Surveillance,” is an existing program with enhancements that is consistent with the program elements in GALL Report AMP X1.M31, “Reactor Vessel Surveillance.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this audit report will be addressed in the SER. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “reactor vessel,” “embrittlement,” “crack,” and “fluence.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.17	Reactor Vessel Surveillance – B2.1.17, NUREG-1801 Program XI.M31	Revision 3, 6/5/2012
2.	Callaway Plant Operating Experience Summary Report, XI.M31, “Reactor Vessel Surveillance”	3/9/2012
3.	Callaway Plant License Renewal Aging Management Industry Operating Experience Report for AMP XI.M31, “Reactor Vessel Surveillance” B2.1.17	3/9/2012
4. WCAP-15400	Analysis of Capsule X from Ameren-UE Callaway Unit 1 Reactor Vessel Radiation Surveillance Program	Revision 0, June 2000
5. WCAP-17168-NP	Callaway Unit 1 Time-Limited Aging Analysis on Reactor Vessel Integrity	Revision 0, September 2010

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program, as modified by the proposed enhancements.

During the audit, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. In addition, the staff found that for the “detection of aging effects,” program element, sufficient information was not available to determine if it was consistent with the corresponding program element of the GALL Report AMP. To obtain the information necessary to verify if this program element is consistent with the corresponding program element of the GALL Report AMP, the staff will consider issuing RAIs for the subject discussed below.

The “detection of aging effects” program element of the LRA AMP states that the last-tested surveillance capsule removed from the reactor vessel was exposed to neutron fluence equivalent to about 54 effective full power years (EFPY) at the reactor vessel wall, which exceeds 60-year peak reactor vessel wall neutron fluence. The “detection of aging effects” program element of GALL Report AMP XI.M31 recommends that a plant-specific reactor vessel surveillance program have at least one capsule with a projected neutron fluence equal to or exceeding the 60-year peak reactor vessel wall neutron fluence before the end of the period of extended operation. To verify that this element of the LRA AMP is consistent with the recommendation in the GALL Report AMP, the staff requires the neutron fluence to which the last-tested surveillance capsule was exposed, which was not provided in the LRA AMP.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.M31. The staff also identified certain aspects of LRA program element “detection of aging effects” that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.18, One-Time Inspection

Summary of Information in the Application. The LRA states that AMP B2.1.18, “One-Time Inspection,” is a new program that is consistent with the program elements in GALL Report AMP XI.M32, “One-Time Inspection.” To verify this claim of consistency, the staff audited the LRA AMP.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant’s operating experience database using the keywords: “loss of material” and “cracking.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.18	One-Time Inspections	Revision 2
2. OTI-TBD	One-Time Inspection Program	Draft

During the audit of program elements 1–6, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). Based on a review of the applicant’s analysis and the staff’s independent review of plant-specific operating experience related to the existing Water Chemistry, Fuel Oil Chemistry, and Lubricating Oil Analysis programs, loss of material, cracking, and reduction of heat transfer are not occurring or are progressing so slowly as to have a negligible effect on the intended function. Therefore, the One-Time Inspection

program satisfies the AMP XI.M32 recommendation that it can only be used for structures or components with no known age-related degradation mechanisms.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.M32.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, when implemented by the applicant, will be used to confirm the absence of aging effects that will be managed by the program before the period of extended operation. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.19, Selective Leaching

Summary of Information in the Application. The LRA states that AMP B2.1.19, “Selective Leaching,” is a new program, with exceptions, that will be consistent with the program elements in GALL Report AMP XI.M33, “Selective Leaching.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER. This audit report does not consider the sufficiency of exceptions, which will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant’s operating experience database using the keywords: “cast,” “leach,” and “dealloy.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1.	Callaway Plant Unit 1 License Renewal Application	12/2011
2. CW-AMP-B2.1.19	Selective Leaching - Callaway Plant	Revision 3
3.	One-Time Inspection for Selective Leaching	Draft
4. APA-ZZ-00500	Corrective Action Program	
5. APA-ZZ-00703,	Fire Protection Operability Criteria and Surveillance Requirements	
6. CAR No. 200909091		
7. CAR No. 201009835		

The staff conducted its audit of LRA program elements 1–6, based on the contents of the new program. Aspects of the “parameters monitored or inspected” and “monitoring and trending” program elements of the LRA AMP that are not associated with the exception were evaluated and are described below.

During the audit, the staff verified that the “scope of program,” “preventive actions,” “detection of aging effects,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. The staff also verified that aspects of the “parameters monitored or inspected,” and “monitoring and trending” program elements not associated with the exception are consistent with the corresponding program elements in the GALL Report AMP. The staff’s evaluation of aspects of these program elements associated with the exception will be addressed in the SER. Although associated with the exception to LRA program elements “parameters monitored or inspected,” and “monitoring and trending,” the staff will consider issuing RAIs for the subject discussed below.

The applicant took an exception to GALL Report AMP XI.M33 for buried gray cast iron components, stating that these components do not need to be inspected for selective leaching if the components are within the scope of the fire protection system, have been installed in accordance with NFPA 24, and the activity of the jockey pump is monitored on an interval not to exceed 1 month. The applicant stated that the exception is consistent with the fire protection aging management requirements of GALL Report AMP XI.M41, “Buried and Underground Piping and Tanks.” However, GALL Report AMP XI.M41 states that the program does not address selective leaching, and that GALL Report AMP XI.M33 is applied in addition to this (AMP XI.M41) program.

During the audit of the “operating experience” program element, the staff noted that in the LRA, the applicant stated that the Callaway Corrective Action Program was reviewed to determine if selective leaching has been identified for components with the applicable material and environment combinations, and that the review identified no occurrences of selective leaching at Callaway. However, in the AMP basis document, the applicant did identify two Callaway Action Requests (CARs) in which selective leaching was identified. The staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “preventive actions,” “detection of aging effects,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.M33. The staff also verified that for the “parameters monitored or inspected,” and “monitoring and trending,” program elements, the aspects of the LRA AMP program elements not associated with the exceptions are consistent with the corresponding program elements in GALL Report AMP XI.M33. The staff’s evaluation of aspects of the program elements associated with exceptions will be addressed in the SER.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.20, One-Time Inspection of ASME Code Class 1 Small-Bore Piping

Summary of Information in the Application. The LRA states that AMP B2.1.20, “One-Time Inspection of ASME Code Class 1 Small-Bore Piping,” is a new program that is consistent with the program elements in GALL Report AMP XI.M35, “One-Time Inspection of ASME Code Class 1 Small-Bore Piping.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff conducted an independent database search of the applicant’s operating experience database using the keywords: “cracking,” “corrosion,” “cyclic,” “degradation,” “damage,” “socket,” “fatigue,” “rupture,” “thermal,” “through-wall,” “weld,” and “leak.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed		
Document	Title	Revision/Date
1. CW-AP-B2.1.20	One-Time Inspection of ASME Code Class 1 Small-Bore Piping B2.1.20	Revision 2, 10/06/2011
2. E170.0105	Callaway NPP Third Interval Inservice Inspection Plan	Revision 5
3. CAR 199501891	RCS Leak Detected in Line BB-74-BCA-2”	10/04/1995
4. RDD985554201000	Babcock & Wilcox Research & Development Division “Examination of Failed Cross Over Drain Line from Callaway Unit 1”	04/1997
5.	Callaway Plant License Renewal Component List Class 1 Small-Bore Piping	

During the audit of program elements 1–6, the staff verified that the “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. For the “scope of program” program element, insufficient information was available to determine if it was consistent with the corresponding program element of the GALL Report AMP. To obtain the information necessary to verify if this program element is consistent with the corresponding program element of the GALL Report AMP, the staff will consider issuing an RAI for the subject discussed below.

LRA Section B2.1.20 states that the applicant’s unit has 19 Class 1 small-bore socket welds in the population of ASME Code Class 1 piping less than nominal pipe size (NPS) 4 and greater than or equal to NPS 1. During the audit, the applicant stated that a recent recount by the applicant, subsequent to the submission of the LRA, had indicated

that there are in fact 23 Class 1 small-bore socket welds. Therefore, the applicant will need to amend LRA Sections A1.20 and B2.1.20 to reflect the correct number of in-scope socket welds for the applicant's AMP. The staff further noted that its recent reviews of other similar PWR facilities have shown the number of reported in-scope socket welds to be roughly twice the number counted by the applicant, suggesting the need for a possible verification.

During the audit of the "operating experience" program element, the staff determined that the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff's independent database search is sufficient to allow the staff to verify that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR. However, as noted above, the FSAR supplement will need to be amended to reflect the correct population of in-scope socket welds.

Audit Results. Based on this audit, the staff verified that LRA program elements "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" are consistent with the corresponding program elements in GALL Report AMP XI.M35. The staff also identified certain aspects of LRA program element "scope of program" that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage the effects of aging. In addition, the staff identified a need for additional information regarding the adequacy of the program description in the FSAR supplement.

LRA AMP B2.1.21, External Surfaces Monitoring of Mechanical Components

Summary of Information in the Application. The LRA states that AMP B2.1.21, "External Surfaces Monitoring of Mechanical Components," is a new program that is consistent with the program elements in GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components." To verify this claim of consistency, the staff audited the LRA AMP.

Audit Activities. During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant's operating experience database using the keywords: "loss of material," "cracking," and "hardening and loss of strength."

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff's search of the applicant's operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.21	External Surfaces Monitoring of Mechanical Components Document Title	Revision 2
2. EDP-ZZ-xxxxx	External Surfaces Monitoring of Mechanical Components Program Document Title	Revision 000
3. EDP-ZZ-01131	Plant Health and Performance Monitoring Program	Revision 021
4. EDP-ZZ-01131	Plant Health and Performance Monitoring Program, Appendix K, Engineering System Walkdowns	Revision 001

During the audit of program elements 1–6, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.M36.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B.2.1.22, Flux Thimble Tube Inspection

Summary of Information in the Application. The LRA states that AMP B2.1.22, “Flux Thimble Tube Inspection,” is an existing program that is consistent with the program elements in GALL Report AMP XI.M37, “Flux Thimble Tube Inspection.” To verify this claim of consistency, the staff audited the LRA AMP.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “thimble tube,” “thimble tube wear,” “wear rate,” and “capped tube.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff's search of the applicant's operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. EDP-ZZ-01003	Inservice Inspection Program	Revision 25
2. NRC Bulletin No. 88-09	Thimble Tube Thinning in Westinghouse Reactors	09/30/1988
3. ULNRC-2049	Report on the Results of Incore Thimble Tube Testing	07/28/1989
4. ETP-BB-01200	Incore Flux Thimble Tube Inspection Program	Revision 0
5. CW-CL-XI-M37	Flux Thimble Tube Inspection	Revision 0

During the audit of program elements 1–6, the staff found that program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff found that the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also found that the operating experience provided by the applicant and identified by the staff's independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is adequate to detect and manage the effects of aging during the period of extended operation.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.M37.

Based on this audit the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR

LRA AMP B2.1.23, Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components

Summary of Information in the Application. The LRA states that AMP B2.1.23, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components,” is a new program with an exception that is consistent with the program elements in GALL Report AMP XI.M38, “Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in

this report will be addressed in the SER. This audit report does not consider the sufficiency of exceptions, which will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant's operating experience database using keywords: "loss of material" and "cracking."

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff's search of the applicant's operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.23	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Revision 2
2. EDP-ZZ-01131	Plant Health and Performance Monitoring Program	Revision 021
3. APA-ZZ-00500	Corrective Action Program	Revision 054
4. EDP-ZZ-01128	Maintenance Rule Program	Revision 018
5. EDP-ZZ-xxxxx	Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components	Revision 000

The staff conducted its audit of LRA program elements 1–6, based on the contents of the new program. Aspects of the "scope of program," "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending," program elements of the LRA AMP associated with the exception were not evaluated during this audit. Aspects of these program elements that are not associated with the exception were evaluated and are described below.

During the audit, the staff verified that the "preventive actions" and "acceptance criteria" program elements of the LRA AMP are consistent with the corresponding element of the GALL Report AMP. The staff also verified that aspects of the "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending," program elements not associated with the exception are consistent with the corresponding program elements in the GALL Report AMP. The staff's evaluation of aspects of these program elements associated with the exception will be addressed in the SER. In addition, the staff found that for the "scope of program" program element, sufficient information was not available to determine if it was consistent with the corresponding program element of the GALL Report AMP. To obtain the information necessary to verify if this program element is consistent with the corresponding program element of the GALL Report AMP, the staff will consider issuing RAIs for the subject discussed below.

The "scope of program" program element of the LRA AMP does not state a summary description of the components included in the program. The GALL Report AMP recommends that the program include internal surfaces of metallic piping, piping components, ducting, polymeric, and other components. It is not clear to the staff that these statements are consistent because the LRA AMP does not define the components that will be age managed within the program.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR supplement was an adequate description of the LRA AMP. To obtain the information necessary to verify the sufficiency of the FSAR supplement program description, the staff will consider issuing RAIs for the subject discussed below.

The FSAR supplement does not include key elements of the recommended program description in SRP-LR Table 3.0-1, and omits that for inaccessible components a plant-specific program will be applied. The FSAR supplement also states that the program will use a “representative sample” as part of the program but does not describe the sample size, the percentage or number of components involved in the sample, nor the method by which components would be selected for the sample.

Audit Results. Based on this audit, the staff verified that LRA program elements “preventive actions” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.M38. The staff also verified that for the “parameters monitored or inspected,” “detection of aging effects,” and “monitoring and trending,” program elements, the aspects of the LRA AMP program elements not associated with the exception are consistent with the corresponding program elements in GALL Report AMP XI.M38. The staff’s evaluation of aspects of the program elements associated with exceptions will be addressed in the SER. The staff also identified certain aspects of LRA program element “scope of program” that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage the effects of aging. In addition, the staff identified a need for additional information regarding the adequacy of the program description in the FSAR supplement.

LRA AMP B2.1.24, Lubricating Oil Analysis

Summary of Information in the Application. The LRA states that AMP B2.1.24, “Lubricating Oil Analysis,” is an existing program with enhancements that is consistent with the program elements in GALL Report AMP XI.M39, “Lubricating Oil Analysis.” To verify this claim of consistency, the staff audited the LRA AMP. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of

the applicant's operating experience database using keywords: "contamination," "lube oil," and "particulate."

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff's search of the applicant's operating experience database.

Relevant Documents Reviewed		
Document	Title	Revision/Date
1. APA-ZZ-00107	Review of Current Industry Operating Experience	Revision 15
2. APA-ZZ-00330	Preventive Maintenance Program	Revision 36
3. APA-ZZ-00500	Corrective Action Program	Revision 53
4. EDP-ZZ-01110	Predictive Maintenance Program	Revision 22
5. EDP-ZZ-01126 Appendix 1	Lubrication Oil Sample Components List	Revision 3
6. EDP-ZZ-01126	Lubrication Predictive Maintenance Program	Revision 11
7. MDP-ZZ-L0001	Lubrication Program	Revision 17
8. OQAM	Operating Quality Assurance Manual	Revision 28B
9. APA-ZZ-00549	Equipment Reliability Improvement Program	Revision 11
10. EDP-ZZ-01131	Plant Health and Performance Monitoring Program	Revision 21

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program as modified by the proposed enhancements.

During the audit, the staff verified that the "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the "operating experience" program element, the staff determined that the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff's independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" are consistent with the corresponding program elements in GALL Report AMP XI.M39.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, will be sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.25, Buried and Underground Piping and Tanks

Summary of Information in the Application. The LRA states that AMP B2.1.25, “Buried and Underground Piping and Tanks,” is a new program with exceptions that will be consistent with the program elements in GALL Report AMP XI.M41, “Buried and Underground Piping and Tanks.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER. This audit report does not consider the sufficiency of exceptions, which will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “buried,” “coating,” “cast,” “chloride,” “corrosive,” “dug,” “excavation,” “cracking,” “damage,” “degradation,” “flaw,” “holiday,” “indication,” “inspection,” “loss of material,” “microbiological,” “pitting,” “sulfate,” and “throughwall.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. NA	Callaway Plant License Renewal Aging Management CAR Operating Experience Report for AMP XI.M41, “Buried and Underground Piping and Tanks” B2.1.25	03/09/2012
2. NA	Callaway Plant License Renewal Component List for AMP XI.M41, “Buried and Underground Piping and Tanks” B2.1.25	03/09/2012
3. CW-AMP-B2.1.25	Callaway Plant Aging Management Program Evaluation Report Buried and Underground Piping and Tanks B2.1.25 NUREG-1801 Program XI.M41	Revision 3, 05/10/2012
4. EDP-ZZ-01011	Buried and Underground Piping and Tanks Inspection Program	Revision 0
5. APA-ZZ-00703	Fire Protection Operability Criteria and Surveillance Results	Revision 20
6.	Cathodic Protection Monitoring	Draft
7. 83470351	CC Technologies Final Report – Indirect Inspections ESW Supply, Return, Discharge, and Strainer Backwash Pipelines	05/02/2007
8. 83475171	Close-Interval Survey (CIS) and Direct Current Voltage Gradient (DCVG) Survey Buried Fire Water Protection Piping	05/07/2008
9. 10513410-500	Annual Cathodic Protection System Survey	08/29/2011
10. 410049	2005 Cathodic Protection Survey and Assessment Report	05/05/2006
11. S-1080	Technical Specification for the Installation of Replacement ASME Section III Buried Essential Service Water System Piping	Revision 1, 10/02/2008
12. E-1026-00012	Cathodic Protection Design Report – Harco	Revision 0, 08/21/1992
13. MTT-ZZ-10011	Installation of Insulation	Revision 5, 05/09/2002
14. CAR 200607749	External Coating Damage Fire Water System – VKC1027D	Unavailable

Document	Title	Revision/Date
15. CAR 200605969	External Corrosion Leak Fire Water System – Near Training Center	Unavailable
16. CAR 200606030	External Corrosion Leak Fire Water System – VKC1087	Unavailable
17. CAR 200703899	Internal MIC Initiated Leak on An Essential Service Water (ESW) Train	Unavailable
18. CAR 200711546	Leak in Fire Water System Downstream of VKC1052	Unavailable
19. CAR 20080871	External Leak on An ESW Train	Unavailable
20. CAR 200207386	Rebar Found in Backfill in Vicinity of Buried Pipe	Unavailable
21. CAR 200702384	Internal MIC Initiated Leak on B ESW Train	Unavailable
22. CAR 200702484	External Corrosion Leak on B ESW Train	Unavailable
23. CAR 200704465	MIC Initiated Leak Corrosion on ESW Trains in Numerous Locations	Unavailable
24. CAR 200808781	Internal MIC Initiated Leak on An ESW Train	Unavailable
25. CAR 200608647	Portions of Cathodic Protection System Not Meeting Acceptance Criteria for the Service Water, Fire Protection, and ESW Systems	Unavailable
26. CAR 200707760	Rectifier Outputs for the EFOST, CST, and FWST are Maxed Out While Not Providing Adequate Protection	Unavailable
27. CAR 200803345	Deepwell Anode DAWQH1007 Is Not Functional	Unavailable
28. CAR 201010950	Several Cathodic Protection Components Are in Need of Repair	Unavailable
29. CAR 201006741	Exterior Cathodic Protection for FWST A is Performing Below Standard	Unavailable

The staff conducted its audit of LRA program elements 1–6, based on the contents of the new program. Aspects of the “preventive actions” and “detection of aging effects” program elements of the LRA AMP associated with the exceptions were not evaluated during this audit. Aspects of these program elements that are not associated with the exceptions were evaluated and are described below.

During the audit, the staff verified that the “parameters monitored or inspected” and “monitoring and trending” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. In addition, the staff found that for the “scope of program,” “preventive actions” “detection of aging effects,” and “acceptance criteria” program elements, sufficient information was not available to determine if they were consistent with the corresponding program elements of the GALL Report AMP. To obtain the information necessary to verify if these program elements are consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing RAIs for the subjects discussed below.

The “scope of program” program element of the LRA AMP states that the emergency diesel engine fuel oil storage and transfer system consists of buried piping and tanks with a safety-related function and also contains hazardous materials. Based on a review of drawing LR-CW-JE-M-22-JE01, the emergency diesel engine fuel oil storage and transfer system also appears to include underground in-scope piping. However, LRA Table 3.3.2-4, “Auxiliary Systems – Summary of Aging Management Evaluation – Essential Service Water System,” does not include any AMR items associated with underground piping.

The “preventive actions” program element of the LRA AMP states that coatings for buried stainless steel piping are only required to protect from a chloride environment to prevent SCC. In addition, it states that the design temperature of the ultimate heat system is 95 °F and the maximum temperature of the RWST is 120 °F, and that this is below the threshold temperature for SCC as stated in GALL Report Section IX.D. The staff recognizes that GALL Report Section IX.D establishes a 140 °F threshold for SCC in stainless steel components; however, it also states, “[w]ith a harsh enough environment (i.e., significant contamination), SCC can occur in austenitic stainless steel at ambient temperature. However, these conditions are considered event-driven, resulting from a breakdown of chemistry controls.” In contrast to the treated water environments, the soil environment is not controlled to preclude the potential for significant levels of contaminants. Given that contaminants can accumulate in the soil due to normal environmental interactions, the 140°F threshold may not apply to buried piping. In addition, the GALL Report, item AP-137 recommends that stainless steel components exposed to soil are susceptible to loss of material due to pitting and crevice corrosion. GALL Report AMP XI.M41, Table 2a, “Preventive Actions for Buried Piping and Tanks,” footnote 3 states, “[c]oatings are provided based on environmental conditions (e.g., stainless steel in chloride containing environments). If coatings are not provided, a justification is provided in the LRA.” During the AMP audit, the applicant did not provide any documentation demonstrating that the soil in the vicinity of the buried stainless steel piping had sufficiently low levels of chlorides and therefore the justification provided by the applicant is insufficient.

The “preventive actions” program element of the LRA AMP states that the preventive actions of the program will be consistent with the GALL Report; however, during its audit the staff identified five CARs spanning 2006 through 2010 citing gaps in cathodic protection system performance. In addition, a Close-Interval Survey (CIS) and Direct Current Voltage Gradient (DCVG) Survey – Buried Fire Water Protection Piping, dated May 2008, stated that 23 percent of the fire protection system, representing 2,658 feet of piping, was inadequately protected. GALL Report AMP XI.M41, “Buried and Underground Piping and Tanks,” recommends that a cathodic protection be installed, monitored, annually tested, and potential differences and current measurements be trended to identify changes in the effectiveness of the system. Given that plant-specific operating experience demonstrates a long period of degraded performance of the cathodic protection system, further details on cathodic protection system availability and effectiveness should be included in the FSAR supplement summary description.

The “detection of aging effects” program element of the LRA AMP states that the fire water jockey pump performance will be monitored in lieu of conducting excavated direct visual examinations of in-scope buried fire water system piping. The GALL Report AMP recommends a similar provision. However, given the numerous leaks in the fire water system piping, it is not clear to the staff that there is adequate sensitivity for monitoring buried fire water piping with the fire water jockey pump.

In relation to the “acceptance criteria” program element, the CIS and DCVG Survey – Buried Fire Water Protection Piping, dated May 7, 2008, recommends that for locations not meeting -850 mV criteria, the station should determine whether the alternative 100 mV potential shift criteria would demonstrate acceptable cathodic protection. In addition, it recommended that locations more negative than -1200 mV be addressed to

ensure that coating disbondment is not occurring. When dissimilar metals are present in the environment (e.g., steel in relation to the copper grounding grid), the 100mV criterion is only acceptable if it can be demonstrated that the most noble metal will be adequately protected. If the applicant will use the 100 mV criterion on in-scope components during the period of extended operation, it must provide the basis for protecting the most noble metal. In addition, to verify consistency with GALL Report AMP XI.M41, the staff must understand the applicant's approach to locations more negative than -1200 mV.

Although not associated with an AMP program element, the staff discussed the following with the applicant during the audit. The LRA cites SRP-LR items 3.3.1-112 and 3.3.1-120 for steel and stainless steel piping, piping components, and other component types embedded in concrete. SRP-LR item 3.3.1-112 addresses steel piping, piping components, and piping elements exposed to concrete for which there is no recommended AERM or AMP, "provided 1) attributes of the concrete are consistent with [American Concrete Institute] (ACI) 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557, and 2) plant operating experience indicates no degradation of the concrete." SRP-LR item 3.3.1-120 addresses stainless steel piping, piping components, and piping elements exposed to concrete as well as other environments (e.g., air-indoor, uncontrolled, gas, dry air) for which there is no recommended AERM or AMP. The "program description" of GALL Report AMP XI.M41 states, "[t]he terms 'buried' and 'underground' are fully defined in Chapter IX of the GALL Report." Briefly, buried piping and tanks are in direct contact with soil or concrete (e.g., a wall penetration). The "scope of program" program element of AMP XI.M41 states, "[t]his program is used to manage the effects of aging for buried and underground piping and tanks constructed of any material including metallic, polymeric, cementitious, and concrete materials." There is an internal misalignment in the GALL Report in that the definition of buried piping and scope of AMP XI.M41 conflicts with items 3.3.1-112 and 3.3.1-120, which state that there is no AERM or recommended AMP for the concrete environment. Regardless of the misalignment, the staff lacks sufficient information to conclude that the in-scope steel and stainless steel piping and piping components embedded in concrete do not need to be age managed by AMP XI.M41.

During the audit of the "operating experience" program element, the staff determined that the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff's independent database search is not sufficient to allow the staff to verify that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage the effects of aging. To obtain the information necessary to determine if the applicant's operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing RAIs for the subject discussed below.

The "operating experience" program element of the LRA AMP states that from 2008 to 2009, portions of the ESW system were replaced with high-density polyethylene (HDPE) piping due to material conditions of the system, including pinhole leaks, pitting, and other localized degradation of the pressure boundary. LRA Table 3.3.2-4 states that there are steel piping, strainer, and valve components in the ESW system exposed to raw water (internal) and a buried environment that have not been replaced. The staff noted that

the Buried and Underground Piping and Tanks Inspection Program, Appendix A, Attachment 1, states that four inspections will be performed on steel ESW piping in each 10-year period starting 10 years before the period of extended operation. Given that these steel components are in the same environment as the replaced piping, it is possible that the degradation of the steel piping will occur at the same rate (on a unit length basis) as experienced by the entire system before replacement. Also, given inconsistent site-wide performance of the cathodic protection system, the staff lacks sufficient information to determine that four inspections each 10-year period will provide reasonable assurance that the CLB function(s) of the portions of the ESW that have not been replaced with HDPE piping will be met.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR supplement was an adequate description of the LRA AMP. To obtain the information necessary to verify the sufficiency of the FSAR supplement program description, the staff will consider issuing the RAI described above associated with the second “preventive actions” program element potential RAI.

Audit Results. Based on this audit, the staff verified that LRA program elements “parameters monitored or inspected” and “monitoring and trending” are consistent with the corresponding program elements in GALL Report AMP XI.M41. The staff also identified certain aspects of LRA program elements “scope of program,” “preventive actions” “detection of aging effects,” and “acceptance criteria” that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also identified that additional information about operating experience is required before a determination can be made about the sufficiency of the LRA AMP to detect and manage the effects of aging. In addition, the staff identified a need for additional information regarding the adequacy of the program description in the FSAR supplement.

LRA AMP B2.1.26, ASME Section XI, Subsection IWE

Summary of Information in the Application. The LRA states that AMP B2.1.26, “ASME Section XI, Subsection IWE,” is an existing program with enhancements that is consistent with the program elements in GALL Report AMP XI.S1, “ASME Section XI, Subsection IWE.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of the auxiliary building, tendon gallery, turbine building, and the exterior of the containment structure. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “IWE,” “containment,” “liner,” “corrosion,” “rust,” and “coating.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff's search of the applicant's operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1.	License Renewal Application – Callaway Plant Unit 1	December 15, 2011
2. CW-AMP-B2.1.26	ASME Section XI, Subsection IWE	Revision 3
3. ESP-ZZ-01016	ASME Section XI IWE Containment Pressure Boundary Inspection	Revision 6
4. APA-ZZ-00500	Corrective Action Program	Revision 53
5. APA-ZZ-00662	ASME Section XI Repair/Replacement Program	Revision 20
6. QCP-ZZ-05040	Visual Examination to ASME VT-1	Revision 22
7. QCP-ZZ-05-42	Visual Examination to ASME VT-3	Revision 19
8. OQAM	Operating Quality Assurance Program	Revision 28A
9. Inspection File: Z170.0001	ASME Section XI IWE Containment Pressure Boundary Inspection	October 1999 Refuel 10
10. Inspection File: Z170.0001	ASME Section XI IWE Containment Pressure Boundary Inspection	October 1999 Refuel 10, Revision 1
11. Inspection File: Z170.0001	ASME Section XI IWE Containment Pressure Boundary Inspection	10/2002 Refuel 12
12. File E190.0101	Callaway NP Containment Pressure Boundary ISI ASME Section XI, Subsection IWE	Revision 3
13. CAR 19992304	Indication Found during IWE VT-3 Exam Exceed Acceptance Criteria	10/05/1999
14. CAR 201108817	During QC's Performance of ASME Section XI, IWE Containment Pressure Boundary Inspection on JOB 08512602/500 Containment Zones 9, 14, 17, 18, 19, 21 As Identified on C-2L2959 and C-2L2960 Did Not Meet the General Visual Inspection Criteria of Procedure ESP-ZZ-01016	10/24/2011
15. CAR 200507146	Pitting on I-Beam from .005 to .025 on Spots on Line Wall	09/21/2005
16. CAR 200811011		
17. CAR 200811479	B Normal Sumps Has Leak in Lower Back Right Corner At The Weld Area	11/03/2008
18. CAR 201104417	Containment Coatings Were Found in a Degraded Condition at the Seal Table (RBB06) During a Containment Inspection	05/26/2011
19.	NCR GL 91017	
20.	NRC IN 2004-09	
21.	NRC IN 2010-12	
22.	NRC IN 1997-10	
23.	NRC Regulatory Issue Summary (RIS) 2011-05	
24. APA-ZZ-00107	Review of Current Industry Operation Experience	Revision 15
25. C-2L2908	Callaway Plant - Reactor Building Liner Plate Floor and Wall Details	Revision 0
26. C-2L2956	Callaway Plant - Pressure Boundary Drawings, Reactor Building Floor Plan, El. 1998'-6"	Revision 1

Document	Title	Revision/Date
27. C-2L2957	Callaway Plant - Pressure Boundary Drawing, Reactor Building Dome Plan	Revision 0
28. C-2L2958	Callaway Plant - Pressure Boundary Drawing, Reactor Building, Floor Details	Revision 0
29. C-2L2959	Callaway Plant - Pressure Boundary Drawing, Reactor Building, Developed Elevations	Revision 1
30. C-2L2960	Callaway Plant - Pressure Boundary Drawing, Reactor Building, Developed Elevations	Revision 0
31. C-2L2961	Callaway Plant - Pressure Boundary Drawing, Reactor Building, Personnel Access Hatch	Revision 0
32. C-2L2962	Callaway Plant - Pressure Boundary Drawing, Reactor Building, Equipment Hatch	Revision 0
33. C-2L2963	Callaway Plant - Pressure Boundary Drawing, Reactor Building, Encapsulated Containment, Recirc. Sump Piping Plan % Typical Penetration Details	Revision 0

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program as modified by the proposed enhancements.

During the audit, the staff verified that the “scope of program,” “preventive actions,” and “detection of aging effects,” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. In addition, the staff found that for the “parameters monitored or inspected,” “monitoring and trending” and “acceptance criteria” program elements, sufficient information was not available to determine if they were consistent with the corresponding program elements of the GALL Report AMP. To obtain the information necessary to verify if these program elements are consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing RALs for the subjects discussed below.

The “parameters monitored or inspected” program element of the LRA AMP does not consider the moisture barriers as part of the IWE program. The GALL Report AMP recommends the examination of the moisture barriers for wear, damage, erosion, tear, surface cracks, or other defects that permit intrusion of moisture in the inaccessible areas of the pressure retaining surfaces of the metal containment shell or liner. It is not clear to the staff that these statements are consistent because the moisture barriers are not considered within the IWE program, and no examinations of them were identified in the surveillance reports.

The “monitoring and trending” and “acceptance criteria” program elements of the LRA AMP state that the site procedure, ESP-ZZ-01016, Revision 06, establishes the IWE ISI program for the containment metallic liner, penetrations of Class CC pressure-retaining components, their integral attachments and Class MC pressure rating components per the ASME Code, Section IWE, 2001 edition through the 2003 addenda. The procedure further states that to detect evidence of degradation, the applicable examination methods are “general visual” and “detailed visual.” The GALL Report AMP recommends the 2004 edition as approved in 10 CFR Part 50.55a of ASME Code, Section XI, Subsection IWE, and to detect evidence of degradation, the applicable examination methods are “general visual,” “VT-3 visual,” and “VT-1 visual.” It is not clear to the staff that these statements are consistent because the applicable visual examination methods

in the GALL recommended Code Edition may not be appropriately addressed in the site procedure, ESP-ZZ -01016, Revision 06.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “preventive actions,” and “detection of aging effects” are consistent with the corresponding program elements in GALL Report AMP XI.S1. The staff’s evaluation of aspects of the program elements associated with enhancements that are not necessary for consistency will be addressed in the SER. The staff also identified certain aspects of LRA program elements “parameters monitored or inspected,” “monitoring and trending,” and “acceptance criteria” that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.27, ASME Section XI, Subsection IWL

Summary of Information in the Application. The LRA states that AMP B2.1.27, “ASME Section XI, Subsection IWL,” is an existing program that is consistent with the program elements in GALL Report AMP XI.S2, “ASME Section XI, Subsection IWL.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of the auxiliary building, tendon gallery, turbine building, and the exterior of the containment structure. The staff also conducted an independent search of the applicant’s operating experience database using the keywords: “IWL,” “containment,” “concrete,” “tendon,” “sheath,” and “leak.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1.	License Renewal Application – Callaway Plant Unit 1	December 15, 2011
2. CW-AMP-B2.1.27	ASME Section XI, Subsection IWL	Revision 1
3. ESP-ZZ-01012	Containment Post-Tensioning System Inspection	Revision 7
4. C-1003	Specification for ISI of the Containment Building Post-Tensioning System and Exterior Concrete Shell	Revision 12
5. APA-ZZ-00662	ASME Section XI Repair/Replacement Program	Revision 19
6. APA-ZZ-00500	Corrective Action Program	Revision 52
7. CECTIP	Callaway NP Containment Exterior Concrete and Tendon Inspection Program	Revision 3
8. CA-N1042-500	Precision Surveillance Corporation (PSC) Report Engineering File No 261 “Twentieth Year Surveillance of the Post-Tensioning System at the Callaway NP”	Revision 0
9. CA-N1042-500	Final Report for the 25th Year Containment IWL Inspection	2010
10. FSAR-SP	Section 16.6.1.2.1	Revision OL-18
11. Inspection E170.0105	Callaway NP Containment Exterior Concrete and Tendon Inspection Program	Revision 2
12. Inspection E190.0100	Callaway NP Containment Exterior Concrete and Tendon Inspection Program	Revision 3
13. APA-ZZ-00107	Review of Current Industry Operating Experience.	Revision 15
14. CAR 201004223	Containment Post-Tensioning System Tendon 33CB Wire Did Not Meet the Elongation Acceptance Criteria during the Lab Testing of the Removed Tendon Wire	05/04/2010
15. OQAM	Operating Quality Assurance Manual	Revision 28A
16. CAR 200407394	20th Year Tendon Surveillance Concrete Inspection Report	09/23/2004
17. CAR 201009755	Evaluate NRC IN 1999-10, Rev. 1, Degradation of Prestressing Tendon Systems	10/12/2010
18. CAR 201009713	No Documentation Could Be Found Indicating Callaway Evaluated NRC IN 99-10	10/11/2010
19. Generic Safety Issue 118	Tendon Anchor Head Failure – NRC IN 85-10	Revision 1
20. CAR 200902154	ASME Sec XI Subsection IWL Requirements Were Not Fully Met for 20th Year Tendon Surveillance. See X.S1, LRA Sec B3.3	03/16/2009
21. CAR 201009644	See X.S1, LRA Sec B3.3 – The Tendon Force Data Collected for Year 3 is Missing and Not Used in the Regression Analysis in the Final Report for the 20th Year Containment IWL Inspection	10/07/2010
22. CAR 201104410	Tendon Grease Can Leaking in Tendon Gallery	05/26/2011
23. CAR 200609470	Ground-Water Leakage AB 1974	11/15/2006
24. CAR 201004223	Refuel 17: IWL L2.20 Tendon Wire Elongation Requirements Were Not Met during Test. See Sept. 9, 2010 Owner’s Activity Reports (OAR-1) for Refuel 17	05/04/2010

Document	Title	Revision/Date
25. SA10-ES-S02	Simple Self-Assessment Report – CAR 201000189 Containment Post Tensioning System Objectives: (1) To determine any improvement opportunities in surveillance process or in overall program (2) The best practices that could be used	12/08/2010
26. C-0101(Q)	Bechtel SNUPPS, Reactor Building, Prestressing Requirements, Typical Details	Revision 06
27. C-0102(Q)	Bechtel SNUPPS, Reactor Building, Prestressing Requirements, Wall Details	Revision 02
28. C-0103(Q)	Bechtel SNUPPS, Reactor Building, Prestressing Requirements, Equipment Hatch Details	Revision 02
29. C-0104(Q)	Bechtel SNUPPS, Reactor Building, Prestressing Requirements, Personnel Hatch Details	Revision 06
30. C-0105(Q)	Bechtel SNUPPS, Reactor Building, Prestressing Requirements, Developed Tendon Layout	Revision 02
31. C-01-301	Inland Ryerson – Bechtel SNUPPS, Vertical Sheathing and Trumplate Location 90 to 270	Revision J
32. C-01-302	Inland Ryerson – Bechtel SNUPPS, Vertical Sheathing and Trumplate Location 270 to 90	Revision J
33. C-01-305	Inland Ryerson – Bechtel SNUPPS, Wall Tendon Development Elevation	Revision S
34. C-01-309	Inland Ryerson – Bechtel SNUPPS, Section Details of Equipment Hatch Thickened Wall at 128	Revision J
35. C-01-314	Inland Ryerson – Bechtel SNUPPS, Dome Tendon Development	Revision L
36. C-01-318	Inland Ryerson – Bechtel SNUPPS, Developed Dome Tendon Plan (Partial)	Revision N
37. C-01-320	Inland Ryerson – Bechtel SNUPPS, Dome Buttress Sections	Revision C
38. C-01-321	Inland Ryerson – Bechtel SNUPPS, Post-Tensioning Sequence	Revision H
39. C-01-303	Inland Ryerson – Bechtel SNUPPS, Base Slab Gallery and Drain Details	Revision J
40. C-01-304	Inland Ryerson – Bechtel SNUPPS, Key Plan, Buttress and Tendon Details	Revision D

During the audit of program elements 1–6, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” and “monitoring and trending” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. For the “acceptance criteria” program element insufficient information was available to determine if it was consistent with the corresponding program element of the GALL Report AMP. To obtain the information necessary to verify whether this program element is consistent with the corresponding program element of the GALL Report AMP, the staff will consider issuing an RAI for the subject discussed below.

The “acceptance criteria” program element of the LRA AMP states that Callaway acceptance criteria for concrete degradation are in accordance with IWL-2510, and are consistent with ACI 201.1R and ACI 349.3R. The GALL Report AMP recommends the acceptance criteria provided in IWL-2510, which references ACI 201.1R and ACI 349.3R

for identification of concrete degradation. It is not clear to the staff that these statements are consistent because ACI 349.3R was not referenced in any of the plant procedures, and it appears that ACI 349.3R Chapter 5, "Evaluation Criteria," was not used during examinations of the concrete containment building.

During the audit of the "operating experience" program element, the staff determined that the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff's independent database search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. To obtain the information necessary to determine if the applicant's operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing RAIs for the subjects discussed below.

During the walkdown on May 2, 2012, the staff identified cracks mapped around the vertical tendon casing concrete in the tendon gallery. The staff could not determine if they are passive cracks, as defined in ACI 349.3R, and was not able to conclude whether the "Evaluation Criteria" of ACI349.3R was used.

During the walkdown on May 2, 2012, the staff observed that portions of the containment exterior surface were obstructed by the containment vent duct. It was not clear how the containment concrete surface obstructed by the containment vent duct could be visually inspected during the scheduled IWL examinations.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," and "monitoring and trending" are consistent with the corresponding program elements in GALL Report AMP XI.S2. The staff also identified certain aspects of LRA program element "acceptance criteria" that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also identified that additional information about operating experience is required before a determination can be made regarding the sufficiency of the LRA AMP to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.28, ASME Section XI, Subsection IWF

Summary of Information in the Application. The LRA states that AMP B2.1.28, "ASME Section XI, Subsection IWF," is an existing program with enhancements that is consistent with the program elements in GALL Report AMP XI.S3, "ASME Section XI, Subsection IWF." To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the corresponding GALL

Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of the ultimate heat sink cooling tower and the retention pond. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “loss of material,” “torque,” and “support.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.28	Callaway Plant Aging Management Program Evaluation Report: ASME Section XI, Subsection IWF – B2.1.28	Revision 2, 11/11/2011
2. APA-ZZ-00662	ASME Section XI Repair/Replacement Program	Revision 20
3. EDP-ZZ-01003	Inservice Inspection Program	Revision 24
4. QCP-ZZ-05042	Visual Examination to ASME VT-3	Revision 19
5. CARS #: 200507407	Weld between Stanchion and Embed Plate Too Corroded To Inspect	Discovery Date 09/26/2005
6. Detail Information for CARS #: 200507407	Cars and Action Full Detail: Detail Information for CAR: 200507407	Close Date 05/23/2006
7. CARS #: 200704856	ESW Strainer Bases Are Cracked	Discovery Date 05/04/2007
8.	Callaway Plant Unit 1 Union Electric Co. Owner’s Activity Report (Form OAR-1) for Refuel 15	08/08/2007
9.	Callaway Plant Unit 1 Union Electric Co. Owner’s Activity Report (Form OAR-1) for Refuel 16	02/05/2009
10. N-586-1	ASME Code Case N-586-1	05/04/2004
11. N-652-1	ASME Code Case N-652-1	02/20/2004

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program as modified by the proposed enhancements.

During the audit, the staff verified that the “scope of program,” “parameters monitored or inspected,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. In addition, the staff found that for the “preventive actions,” and “detection of aging effects” program elements, sufficient information was not available to determine if they were consistent with the corresponding program elements of the GALL Report AMP. To obtain the information necessary to verify if these program elements are consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing RAIs for the subjects discussed below.

The “preventive action” program element of the LRA AMP does not discuss the use of molybdenum disulfide lubricants and does not clearly state that they have not been used

in the past. The GALL Report AMP recommends refraining from using molybdenum disulfide and other lubricants containing sulfur for high-strength bolting applications. It is not clear to the staff that these statements are consistent because the applicant has no programmatic guidance in place to prohibit the use of molybdenum disulfide lubricants.

The “detection of aging effects” program element of the LRA AMP states that volumetric examinations will be conducted on high-strength bolting; however, no discussion is provided on the number of high-strength bolts within the scope of the program or how the bolts will be selected for inspection. The GALL Report AMP recommends volumetric examination for high-strength structural bolting (actual measured yield strength greater than or equal to 150 ksi or 1,034 MPa) in sizes greater than 1-inch nominal diameter. It is not clear to the staff that these statements are consistent because the applicant does not explain how many bolts will be inspected, or how the bolts will be selected for inspection.

The “preventive action” program element of the LRA AMP includes an enhancement to specify that bolting material, installation torque or tension, and use of lubricants are in accordance with the applicable EPRI guidelines, American Society of Testing and Materials (ASTM) standards, American Institute of Steel Construction (AISC) specifications, and NUREG recommendations to prevent degradation due to SCC. The GALL Report recommends that if bolting consists of ASTM A325, F1852, or A490 bolts, the preventive actions for storage, lubricants, and SCC potential discussed in Section 2 of the Research Council for Structural Connections (RCSC) publication, “Specification for Structural Joints Using ASTM A325 or A490 Bolts,” be used. Although the applicant plans to enhance its program, it is not clear to the staff that the enhancement will adequately capture the recommended guidance in the RCSC document.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. To obtain the information necessary to determine if the applicant’s operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing RAIs for the subject discussed below.

ASME Section XI, Subsection IWF states, that to the extent practical, the same supports selected for examination during the first inspection interval shall be examined during each successive inspection interval. Recent industry operating experience has revealed situations in which supports within the IWF sample were degraded, but did not meet the IWF threshold for repair. The supports were reworked to as-new condition and remained in the IWF sample. The staff’s concern with respect to aging management is that if ASME Code, Section XI, Subsection IWF supports that are part of the inspection sample are reworked to as-new condition, they are no longer typical of the other supports in the population. Subsequent ASME Code, Section XI, Subsection IWF inspections of the same sample would not represent the age-related degradation of the rest of the population. The LRA and the associated basis documents provided no discussion of how this issue would be addressed.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “parameters monitored or inspected,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.S3. The staff also identified certain aspects of LRA program elements “preventive actions,” and “detection of aging effects” that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also identified that additional information on operating experience is required before a determination can be made about the sufficiency of the LRA AMP to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.29, 10 CFR Part 50, Appendix J

Summary of Information in the Application. The LRA states that AMP B2.1.29, “10 CFR Part 50, Appendix J,” is an existing program that is consistent with the program elements in GALL Report AMP XI.S4, “10 CFR Part 50, Appendix J.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of the auxiliary building, tendon gallery, turbine building, and the exterior of the containment structure. The staff also conducted an independent database search of the applicant’s operating experience database using the keywords: “Appendix J,” “leak rate testing,” “ILRT,” and “LLRT.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.29-3	10 CFR Part 50, Appendix J	Revision 3, 12/14/2011
2. CW-OE-CAR-200405610	Containment Hatch Barrel LRT (ISP-SM-LL0L3) Failure (R570993B)	Revision 1, 12/06/2010
3. CW-OE-NRC IN 85-08	Industry Experience on Certain Materials Used in Safety-Related Equipment – As reviewed and evaluated by CW	Revision 2, 07/22/2011
4. CW-OE-NRC IN 92-20 UOTE 92-095	Inadequate LLRT– As reviewed and evaluated by CW	Revision 0, 12/06/2010
5. CW-OE-NRC IN 97-10	Liner Corrosion in Concrete Containments – As reviewed and evaluated by CW	Revision 1, 09/15/2011
6. CW-OE-NRC IN 2004-09	Corrosion of Steel Containment and Containment Liner – As reviewed and evaluated by CW	Revision 1, 09/15/2011

Document	Title	Revision/Date
7. CW-OE-NRC IN 2010-12 CAR201006117	Containment Liner Corrosion – As reviewed and evaluated by CW	Revision 1, 09/15/2011
8. CW-OE-NRC IN 85-08	Industry Experience on Certain Materials Used in Safety-Related Equipment – As reviewed and evaluated by CW	Revision 2, 07/22/2011
9. CW-AMP- CMPLIST	CW License Renewal Component List (CMPLIST)	03/21/2012
10. ESP-SM-01001	Containment LRT Program	Revision 23
11. ESP-GP-01007	Reactor Building ILRT	Revision 12
12. APA-ZZ-00500	Corrective Action Program	
13. ESP-ZZ-01016	ASME Section XI IWE Containment Pressure Boundary Inspection	Revision 6
14. ESP-ZZ-01011	Containment Structural Integrity Inspection	Revision 6
15. OSP-GP-LL036	Containment Isolation Flange Leak Rate Test	Revision 5
16. OSP-GP-LL050	Containment Isolation Flange Leak Rate Test	Revision 5
17. OSP-GP-LL068	Containment Isolation Flange Leak Rate Test	Revision 5
18. APA-ZZ-00101	Processing Procedures, Manuals, and Desktop Instructions	Revision 61
19. C-2L2956	Callaway Plant – Pressure Boundary Drawings, Reactor Building Floor Plan, El. 1998'-6"	Revision 1, 09/28/2005
20. C-2L2957	Callaway Plant – Pressure Boundary Drawing, Reactor Building Dome Plan	Revision 0, 09/02/1999
21. C-2L2958	Callaway Plant – Pressure Boundary Drawing, Reactor Building, Floor Details	Revision 0, 09/02/1999
22. C-2L2959	Callaway Plant – Pressure Boundary Drawing, Reactor Building, Developed Elevations	Revision 1, 09/02/1999
23. C-2L2960	Callaway Plant – Pressure Boundary Drawing, Reactor Building, Developed Elevations	Revision 0, 09/02/1999
24. C-2L2961	Callaway Plant – Pressure Boundary Drawing, Reactor Building, Personnel Access Hatch	Revision 0, 09/02/1999
25. C-2L2962	Callaway Plant – Pressure Boundary Drawing, Reactor Building, Equipment Hatch	Revision 0, 09/02/1999
26. C-2L2963	Callaway Plant – Pressure Boundary Drawing, Reactor Building, Encapsulated Containment, Recirc. Sump Piping Plan – Typical Penetration Details	Revision 0 09/02/1999

During the audit of program elements 1–6 the staff verified that the “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. For the “scope of program” program element, insufficient information was available to determine if it was consistent with the corresponding program elements of the GALL Report AMP. To obtain the information necessary to verify if this program element is consistent with the corresponding program element of the GALL Report AMP, the staff will consider issuing an RAI for the subject discussed below.

The “scope of program” program element includes all of the pressure retaining components of the containment structure. However, the plant’s FSAR-SP and leak rate test (LRT) procedure, state that certain Type B and/or C components are excluded from local leak rate tests (LLRT). In addition, for certain penetrations the plant has substituted LLRTs in place of VT-2 Inspections. It is not clear how the applicant will

manage the aging effects for the components excluded from 10CFR Part 50, Appendix J testing or inspections during the period of extended operation.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.S4. The staff also identified certain aspects of LRA program element “scope of program” that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.30, Masonry Wall

Summary of Information in the Application. The LRA states that AMP B2.1.30, “Masonry Wall,” is an existing program that is consistent with the program elements in GALL Report AMP XI.S5, “Masonry Wall,” and is integrated and implemented as part of the Structures Monitoring Program (B2.1.31). To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of the auxiliary building and the turbine building lube oil storage tank room. The staff also conducted an independent search of the applicant’s operating experience database using the keywords: “degradation,” “cracking,” “masonry,” and “concrete.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.30	Callaway Plant Aging Management Program Evaluation Report: Masonry Walls – B2.1.30	Revision 1, 07/18/2011
2. ESP-ZZ-01013	Maintenance Rule Structures Inspection	Revision 6
3. EDP-ZZ-01128	Maintenance Rule Program	Revision 18
4.	Maintenance Rule Walkdown Report – Turbine Building	08/31/2005
5.	Maintenance Rule Walkdown Report – Turbine Building	04/16/2009

During the audit of program elements 1–6, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” and “monitoring and trending” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. For the “acceptance criteria” program element insufficient information was available to determine if it was consistent with the corresponding program element of the GALL Report AMP. To obtain the information necessary to verify if this program element is consistent with the corresponding program element of the GALL Report AMP, the staff will consider issuing RAIs for the subject discussed below.

The “acceptance criteria” program element of the LRA AMP basis document provides proposed quantitative acceptance criteria for masonry walls as an enhancement to the program. However, no basis is provided for the proposed acceptance criteria. The GALL Report AMP recommends further evaluation if the extent of cracking and loss of material identified is sufficient to affect the intended function of the wall or invalidate its evaluation basis. It is not clear to the staff that these statements are consistent because the applicant did not provide a basis for the acceptance criteria, nor did it compare the acceptance criteria in the basis documents to the recommended guidance in the GALL Report.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR supplement was an adequate description of the LRA AMP. To obtain the information necessary to verify the sufficiency of the FSAR supplement program description, the staff will consider issuing RAIs for the subject discussed below.

The GALL Report AMP XI.S5, “Masonry Walls,” recommends structures within scope of the program be inspected on a frequency not to exceed 5 years. The “detection of aging effects” program element in the LRA basis document states that inspections are performed at intervals no more than 5 years; however, no discussion of inspection interval is provided in the LRA or the FSAR supplement program description. This level

of detail needs to be captured in the FSAR supplement to provide the staff assurance that the programs will be properly implemented during the period of extended operation.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” and “monitoring and trending” are consistent with the corresponding program elements in GALL Report AMP XI.S5. The staff also identified certain aspects of LRA program element “acceptance criteria” that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff identified a need for additional information regarding the adequacy of the program description in the FSAR supplement.

LRA AMP B2.1.31, Structures Monitoring

Summary of Information in the Application. The LRA states that AMP B2.1.31, “Structures Monitoring,” is an existing program with enhancements that is consistent with the program elements in GALL Report AMP XI.S6, “Structures Monitoring.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of different in-scope structures, including the auxiliary, fuel, turbine and reactor buildings. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “concrete,” “corrosion,” “damage,” “degradation,” “erosion,” “excavation,” “leaching,” “loss of material,” “rust,” “spalling,” and “underground.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.31	Callaway Plant Aging Management Program Evaluation Report, Structures Monitoring – B2.1.31	Revision 3, 03/05/2012
2. ESP-ZZ-01013	Maintenance Rule Structures Inspection, Including Appendices A through D	Revision 6
3. CAR No. 200609470	Groundwater in-leakage AB 1974	
4. Doc No. 91017	Generic Safety Issue 29, “Bolting Degradation or Failure in Nuclear Power Plants”	07/19/2011
5. CAR No. 200200434	Leaking Roof/Equipment Stores 1 Office Area	08/26/2010

Document	Title	Revision/Date
6. CAR No. 200200983	Degradation of Isolation Joint Seals	08/26/2010
7. CAR No. 200900096	Support Beams Under Intake Strainers Corroded	09/10/2010
8. CAR No. 200803956	Slow Leak Through Concrete Wall Near PDA2101A, CIRC Water Pump A	08/26/2010
9. CAR No. 200801207	Concrete Wall Degradation in the 'D' UHS Cooling Tower Fan Room	11/15/2010
10. CAR No. 200703872	Several Small Roof Leaks above the Spent Fuel Pool	08/30/2010

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program as modified by the proposed enhancements.

During the audit, the staff verified that the “preventive actions” program element of the LRA AMP is consistent with the corresponding element of the GALL Report AMP. In addition, the staff found that for the “scope of program,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements, sufficient information was not available to determine if they were consistent with the corresponding program elements of the GALL Report AMP. To obtain the information necessary to verify if these program elements are consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing RAIs for the subjects discussed below.

Element 1, “scope of program,” of the Structures Monitoring program basis document as well as the implementing procedure, ESP-ZZ-01013 of the Structures Monitoring program, has excluded penetrations, pipe and raceway supports, cable trays, anchor bolts, transmission towers, electrical conduits, and ultimate heat sink retention pond from the scope of existing AMP before the period of extended operation. The GALL Report AMP recommends that the scope of the program include all structures, structural components, component supports, and structural commodities in the scope of license renewal, including structures, structural components, and commodities not covered by other structural AMPs. Examples of structures, structural components, and commodities in the scope of license renewal are concrete and steel structures, structural bolting, anchor bolts and embedments, component support members, pipe whip restraints and jet impingement shields, transmission towers, panels and other enclosures, racks, sliding surfaces, sump and pool liners, electrical cable trays and conduits, trash racks associated with water control structures, electrical duct banks, manholes, doors, penetration seals, and tube tracks. It is not clear to the staff how structures currently excluded from the existing implementing procedure of the ESP-ZZ-01013 will be inspected and degradations trended prior to the period of extended operation.

Element 3 “parameters monitored or inspected,” of the LRA Structures Monitoring program basis document states that the inspection methods, inspection frequency, and inspector qualifications at Callaway are consistent with the guidance provided in ACI 349.3R-96. However, a review of the Callaway implementing procedure ESP-ZZ-01013, “Maintenance Rule Structures Inspection,” indicates that the inspection methods, including walkdown examination guidance and qualification requirements for inspectors are not consistent with ACI 349.3R. The GALL Report AMP recommends

that parameters monitored or inspected are to be commensurate with industry codes, standards, and guidelines and also consider industry and plant-specific operating experience. ACI 349.3R and ANSI/ASCE 11 provide an acceptable basis for selection of parameters to be monitored or inspected for concrete and steel structural elements and for steel liners, joints, coatings, and waterproofing membranes. It is not clear to the staff how the implementing procedure ESP-ZZ-01013 is consistent with the GALL Report AMP.

Element 4, "detection of aging effects," of the LRA Structures Monitoring program basis document states that inspections are performed at intervals of not more than 5 years. Although this is stated in the basis documents, no discussion of inspection interval is provided in the LRA or the FSAR supplement program summary. Therefore, the staff will request the applicant to revise the FSAR supplement to incorporate the 5-year inspection interval to provide the staff assurance that the program will be properly implemented during the period of extended operation.

The LRA and the program basis document states that groundwater is monitored for pH, chlorides, and sulfates every 5 years, and the results are evaluated by engineering to assess the impact, if any, on below-grade structures. With the exception of two monitoring wells, pH, chlorides, and sulfates concentrations have been within the prescribed limits for non-aggressive groundwater/soil. The two wells have shown seasonal increases in chloride levels of up to 680 mg/L (ppm) while the pH and sulfate concentrations have remained non-aggressive. The GALL Report, program element 4, "detection of aging effects," recommends that for plants with chlorides greater than 500 ppm in the groundwater/soil, a plant-specific AMP accounting for the extent of the degradation experienced should be implemented to manage the concrete aging during the period of extended operation. It is not clear to the staff how the aging of the inaccessible concrete elements will be managed during the period of extended operation due to the presence of high chloride concentrations.

Element 6, "acceptance criteria," of the LRA Structures Monitoring program basis document states that the Callaway Structures Monitoring program provides guidance for the determination of the performance criteria for SSCs included within the scope of the Maintenance Rule (Reference: ESP-ZZ-01013, Appendix B). These guidelines were used to establish the inspection attributes for SSCs. The Callaway Structures Monitoring program uses "Acceptable," "Acceptable with Deficiencies," and "Unacceptable," to classify levels of aging effects for each inspection attribute. Element 6 of the program also states that the Structures Monitoring program will be enhanced to quantify acceptance criteria and critical parameters for monitoring degradation, and procedures will also be enhanced to incorporate applicable industry codes, standards, and guidelines for acceptance criteria. During the audit, the staff reviewed the proposed enhancement described in Appendix D of the procedure ESP-ZZ-01013, and could not find the basis or reference to any industry standard for some of the acceptance criteria. In addition, it is not clear to the staff how the acceptance criteria described in Section 7.5 and Appendix D of the procedure ESP-ZZ-01013 are consistent.

During the audit of the "operating experience" program element, the staff determined that the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., the applicant or the staff did

not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff's independent database search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. To obtain the information necessary to determine if the applicant's operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing RAIs for the subjects discussed below.

Appendix C of the implementing procedure ESP-ZZ-01013 for the Structures Monitoring program states that gaps filled with an elastomeric are deemed to have degraded when they no longer perform their intended function. Functionality is compromised if the elastomer is cracked, torn, brittle, not bonded to adjoining media, or shows signs of in-leakage. Furthermore, an elastomer filled gap is deemed to have degraded if the gap is occupied by a foreign material and is considered to have failed if the as-found gap dimension is less than that prescribed by design. However, during the audit, the staff reviewed corrective action reports and during walkdowns observed that elastomers in the seismic gaps of the containment, turbine, and auxiliary buildings have been degraded and are not functional. In addition, in one area in the auxiliary building the elastomer has been replaced with a foreign material. This condition has caused in-leakage of ground and rain water into the buildings. It is not clear to the staff how the aging of the non-functional elastomeric gaps will be managed and trended during the period of extended operation.

During the audit, the staff performed a walkdown of the reactor building tendon gallery and observed leaching of concrete. The staff also reviewed CAR No. 200806266 that documented the presence of leaching of tendon gallery concrete. The applicant performed chemical analysis of the white substance removed from the leached area and determined that leaching is due to groundwater leakage, and this does not affect the structural integrity of the tendon gallery. There is no discussion about prevention of groundwater leakage and effect of leaching on concrete and rebar. It is not clear to the staff how the applicant plans to monitor and manage aging of the concrete in the tendon gallery affected by leaching.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR supplement was an adequate description of the LRA AMP. To obtain the information necessary to verify the sufficiency of the FSAR supplement program description, the staff will consider issuing an RAI for the subject discussed below.

The FSAR supplement does not describe the inspection frequency for the structures, systems, and components included in the scope of the Structures Monitoring program. This level of detail needs to be captured in the FSAR supplement to provide the staff assurance that the programs will be properly implemented during the period of extended operation.

Audit Results. Based on this audit, the staff verified that the LRA program element "preventive actions" is consistent with the corresponding program element in GALL Report AMP XI.S6. The staff also identified certain aspects of LRA program elements "scope of program," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance

criteria” that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also identified that additional information about operating experience is required before a determination can be made regarding the sufficiency of the LRA AMP to detect and manage the effects of aging. In addition, the staff identified a need for additional information regarding the adequacy of the program description in the FSAR supplement.

LRA AMP B2.1.32, RG 1.127 Inspection of Water-Control Structures Associated with Nuclear Power Plants

Summary of Information in the Application. The LRA states that AMP B2.1.32, “RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants,” is an existing program that is consistent with the program elements in GALL Report AMP XI.S7, “RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants.” This program is implemented as part of the Structures Monitoring Program (SMP). To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted a walkdown of the ultimate heat sink retention pond. The staff also conducted an independent search of the applicant’s operating experience database using the keywords: “retention pond,” “ESW pump house,” and “discharge structure.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.32	Callaway Aging Management Program Evaluation Report, RG 1.127, Inspection of Water-Controlled Structures Associated with Nuclear Power Plants – B2.1.32	Revision 2, 03/23/2012
2. ESP-ZZ-01013	Maintenance Rule Structures Inspection	Revision 6
3. ESP-EF-03002	Ultimate Heat Sink Retention Pond Inservice Inspection	Revision 6
4. ESP-ZZ-03907	Settlement Monitoring Program	Revision 5
5. FSAR SA Table 2.5-55	Estimated, Measured, and Allowable Settlements	Rev. OL-13 05/03
6. CAR 200609956	Concrete Wall Degradation in the “D” UHS Cooling Tower Fan Room	
7. CAR 200801207	Concrete Wall Degradation in the “D” UHS Cooling Tower Fan Room	
8. CAR 200502084	Concrete Wall Degradation in the “A” UHS Cooling Tower Fan Room	

During the audit of program elements 1–6, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,”

“monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR supplement was an adequate description of the LRA AMP. To obtain the information necessary to verify the sufficiency of the FSAR supplement program description, the staff will consider issuing an RAI for the subject discussed below.

The FSAR supplement does not describe the inspection frequency for the SSCs included in the scope of the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants AMP. This level of detail needs to be captured in the FSAR supplement to provide the staff assurance that the programs will be properly implemented during the period of extended operation.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.S7.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff identified a need for additional information regarding the adequacy of the program description in the FSAR supplement.

LRA AMP B2.1.33, Protective Coating Monitoring and Maintenance Program

Summary of Information in the Application. The LRA states that AMP B2.1.33, “Protective Coating Monitoring and Maintenance Program,” is an existing program with enhancements and an exception that is consistent with the program elements in GALL Report AMPXI.S8, “Protective Coating Monitoring and Maintenance Program.” To verify this claim of consistency, the staff audited the LRA AMP. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER. This audit report does not consider the sufficiency of exceptions, which will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “coating,” “Service Level 1 coating,” and “paint.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff's search of the applicant's operating experience database.

Relevant Documents Reviewed		
Document	Title	Revision/Date
1. CW-AMP-B2.1.33.	Protective Coating Monitoring and Maintenance	Revision 1, 11/23/2011
2. CAR No. 200810440	XI.S8 Protective Coating Monitoring and Maintenance	
3. CAR No. 201003484	XI.S8 Protective Coating Monitoring and Maintenance	
4. CAR No. 201108490	XI.S8 Protective Coating Monitoring and Maintenance	
5. CAR No. 201108490	XI.S8 Protective Coating Monitoring and Maintenance	

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program as modified by the proposed enhancements. Aspects of the “scope of program,” program element of the LRA AMP associated with the exception were not evaluated during this audit. Aspects of this program element that are not associated with the exception were evaluated and are described below.

During the audit, the staff verified that the “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. The staff also verified that aspects of the “scope of program” program element not associated with the exception are consistent with the corresponding program element in the GALL Report AMP. The staff's evaluation of aspects of this program element associated with the exception will be addressed in the SER.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff's independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff's independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.S8. The staff also verified that for the “scope of program” program element, the aspects of the LRA AMP program element not associated with the exception are consistent with the corresponding program elements in GALL Report AMP XI.S8. The staff's

evaluation of aspects of the program element associated with the exception will be addressed in the SER.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.34, Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Summary of Information in the Application. The LRA states that AMP B2.1.34, “Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements,” is an existing program with enhancements that is consistent with the program elements in GALL Report AMP XI.E1, “Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.” To verify this claim of consistency, the staff audited the LRA AMP. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of the switchyard. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “cable,” “corrosion,” and “cracking.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.34	Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements	Revision 4, 04/27/2012
2. 200701308	Callaway Action Request System – “NRC Generic Letter 2007-01 Responses”	02/12/2007
3. 200704419	Callaway Action Request System – “5KV cable has split insulation to motor DPAD01A	04/24/2007

The staff conducted its audit of LRA program elements 1–7, based on the contents of the existing program as modified by the proposed enhancements.

During the audit, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “acceptance criteria,” and “monitoring and trending” are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent

database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff's independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "acceptance criteria," and "monitoring and trending" are consistent with the corresponding program elements in GALL Report AMP XI.E1. The staff's evaluation of aspects of the program elements associated with enhancements which are not necessary for consistency will be addressed in the SER.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.35, Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits

Summary of Information in the Application. The LRA states that AMP B2.1.35, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits," is an existing program with enhancements that is consistent with the program elements in GALL Report AMP XI.E2, "Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits." To verify this claim of consistency, the staff audited the LRA AMP. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant's operating experience database using keywords: "cable," "corrosion," "connections," "splices," "brittle," "crack," and "degraded."

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff's search of the applicant's operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.35	Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits	Revision 4, 04/27/2012
2. 200404746	Callaway Action Request System – “Signal Noise on N61 Gamma-Metrics Signal Cables B	06/04/2004

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program as modified by the proposed enhancements.

During the audit, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that the LRA program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.E2. The staff’s evaluation of aspects of the program elements associated with enhancements which are not necessary for consistency will be addressed in the SER.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.36, Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Summary of Information in the Application. The LRA states that AMP B2.1.36, “Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements,” is an existing program with enhancements that is consistent with the program elements in GALL Report AMP XI.E3, “Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the

corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of in-scope manholes MH59-31, MH59-01A, MH59-01B, MH59-12, MH59-20, and MH59-19; and switchyard control house cable pit 2, confirming locations, labeling, cover integrity, and susceptibility to surface water runoff. Manhole MH59-12 was opened for inspection. The staff also conducted an independent search of the applicant's operating experience database using keywords: "manhole," "duct," "water," "cable," "underground," and "vault."

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff's search of the applicant's operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.36	Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements – B2.1.36 NUREG 1801 Program XI.E3	Revision 4, 04/13/2012
2. CARS 201101616	Manhole MH01 South (B Train) Contained Approx. 24 Inches of Water	02/28/2011
3. CARS 201008001	Lack of Medium Voltage Cable Strategy	08/21/2010
4. CARS 200905490	Manhole MH01 South (B Train) Contained Approximately 3' 7" of Water	07/10/2009
5. CARS 201104447	Develop Modification Package To Prevent Cable Submergence in Manholes	05/27/2011
6. Job #11004839	Install Sump Pump and Level Indication in MH59-19	02/28/2012
7. Job #11004841	Install Sump Pump and Level Indication in MH59-20	04/02/2012
8. Job #11004842	Install Sump Pump and Level Indication in MH59-12	01/18/2012
9. Job #11004843	Install Sump Pump and Level Indication in MH59-01A	04/13/2012
10. Job # 11004844	Install Sump Pump and Level Indication in MH59-01B	12/22/2011
11. GL 2007-01	Inaccessible or Underground Power Cable Failures That Disable Accident Mitigation Systems or Cause Plant Transients	02/07/2007
12. ULNRC-05415	90 Day Response to NRC Generic Letter 2007-01, Inaccessible or Underground Power Cable Failures That Disable Accident Mitigation Systems or Cause Plant Transients	05/07/2007
13. 05000483/2010005	Callaway Plant – NRC Integrated Inspection Report	01/26/2011
14. 05000483/2011003	Callaway Plant – NRC Integrated Inspection Report	07/18/2011
15. 05000483/2011002	Callaway Plant – NRC Integrated Inspection Report	05/04/2011
16. EDP-ZZ-07001	Cable Management Program	Revision 000ac
17. MP 11-0011	Change Package – Post Change Test Plan	Not applicable
18. CAR 201107826	MH01 South B Train Contained Approx. 2 Inches Water	10/11/2011
19. CAR 200701308	NRC Generic Letter 2007-01 Responses	02/12/2007

Document	Title	Revision/Date
20. 11004845	Install Sump Pump and Level Indication in MH59-04	09/02/2011
21. 11004847	Install Sump Pump and Level Indication in MH59-05	09/02/2011
22. 12001060	Install Sump Pump and Level Indication in MH59-10	02/21/2012

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program as modified by the proposed enhancements.

During the audit, the staff verified that the “preventive actions,” “parameters monitored or inspected,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. In addition, the staff found that for the “scope of program,” and “detection of aging effects,” program elements, sufficient information was not available to determine if they were consistent with the corresponding program elements of the GALL Report AMP. To obtain the information necessary to verify if these program elements are consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing RAls for the subjects discussed below.

The “scope of program” program element of Basis Document CW-AMP-B2.1.36, “Inaccessible Power Cable Not Subject to 10 CFR 50.49 Environmental Qualification Requirements,” does not indicate voltage level of in-scope inaccessible power cable (e.g., greater than or equal to 400 volts). Additionally, FSAR supplement A1.36 does not specify voltage level. The GALL Report AMP recommends the AMP apply to all inaccessible or underground power (greater than or equal to 400 volts) cables within the scope of license renewal that are exposed to adverse environments. It is not clear to the staff that these statements are consistent because it cannot be determined that the applicant’s program includes 400 volt inaccessible power cables.

The “detection of aging effects” program element of Basis Document CW-AMP-B2.1.36, Procedure EDP-ZZ-07001, and FSAR supplement A1.36 do not state that test frequencies are adjusted based on test results as well as operating experience. The GALL Report AMP recommends that for power cables exposed to significant moisture test frequencies be adjusted based on test results (includes trending of degradation where applicable) and operating experience. It is not clear to the staff that these statements are consistent because the applicant’s documents do not include revising test frequencies based on either test results or operating experience.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR supplement was an adequate description of the LRA AMP. To obtain the

information necessary to verify the sufficiency of the FSAR supplement program description, the staff will consider issuing RAIs for the subject(s) discussed below.

FSAR supplement A1.36 does not specify voltage level and does not state that test frequencies are adjusted based on test results as well as operating experience. It is not clear to the staff that these statements are consistent with GALL Report AMP XI.E3.

Audit Results. Based on this audit, the staff verified that LRA program elements “preventive actions,” “parameters monitored or inspected,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.E3. The staff also identified certain aspects of LRA program elements “scope of program,” and “detection of aging effects” that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff identified a need for additional information regarding the adequacy of the program description in the FSAR supplement.

LRA AMP B2.1.37, Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

Summary of Information in the Application. The LRA states that AMP B2.1.37, “Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements,” is a new program that is consistent with the program elements in GALL Report AMP XI.E6, “Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report are addressed in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent database search of the applicant’s operating experience database using the keywords: “cable connections,” “loosening,” and “corrosion.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.37	Callaway Plant Aging Management Program Evaluation Report – Electrical Cable Connection Not Subject to 10 CFR 50.49 Environmental Qualification Requirements – B2.1.37	Revision 3
2. CAR 200000569	Callaway Plant License Renewal Aging Management CAR Operating Experience Report for AMP XI.E6, “Electrical Cable Connections Not Subject to 10 CFR 50.49	01/14/2010
3. CAR 200102076	Callaway Plant License Renewal Aging Management CAR Operating Experience Report for AMP XI.E6, “Electrical Cable Connections Not Subject to 10 CFR 50.49	01/14/2010

Document	Title	Revision/Date
4. EDP-ZZ-07001	Cable Management Program	Revision 000b

During the audit of program elements 1–6, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” and “monitoring and trending” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. For the “acceptance criteria” program element insufficient information was available to determine if it was consistent with the corresponding program elements of the GALL Report AMP. To obtain the information necessary to verify if this program element is consistent with the corresponding program element of the GALL Report AMP, the staff will consider issuing RAIs for the subjects discussed below.

The “acceptance criteria” program element of the Callaway Plant AMP Evaluation Report for Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements AMP states that the acceptance criteria for thermography testing will be based on the temperature rise above the reference temperature. The reference temperature will be ambient temperature or the baseline temperature data from the same type of connections being tested. The applicant referenced Procedure EDP-ZZ-07001 Section 4.3.13. Section 4.3.13 of this procedure states that the acceptance criteria for the review of thermography results for the one-time inspection of cable connections will be based on the temperature rise above a reference temperature. The reference temperature will be ambient temperature or the baseline temperature data from the connections being tested. The procedure does not specify what the acceptance criteria for thermography inspections are. Non-compliance with acceptance criteria is used to perform an evaluation when the test acceptance criteria are not met. The evaluation may include changes to the one-time inspection, increased inspection frequency, and replacement or repair of the affected connections. The GALL Report AMP recommends that cable connections should not indicate abnormal temperature for the application when thermography is used. It is not clear to the staff that these statements are consistent because Procedure EDP-ZZ-07001 Section 4.3.13 does not specify acceptance criterion for thermography inspections.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects” and “monitoring and trending” are consistent with the corresponding program elements in GALL Report AMP XI.E6. The staff also identified certain aspects of LRA program element

“acceptance criteria” that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.38, Monitoring of Neutron-Absorbing Materials other than Boraflex

Summary of Information in the Application. The LRA states that AMP B2.1.38, “Monitoring of Neutron-Absorbing Materials other than Boraflex,” is a new program that is consistent with the program elements in GALL Report AMP XI.M40, “Monitoring of Neutron-Absorbing Materials other than Boraflex.” To verify this claim of consistency, the staff audited the LRA AMP.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of the spent fuel pool building. The staff also conducted an independent search of the applicant’s operating experience database using the keywords: “neutron absorber,” “Boral®,” and “boron.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.38	Monitoring of Neutron-Absorbing Materials other than Boraflex	Revision 1
2. CAR No. 200909146	XI.M40 Monitoring of Neutron-Absorbing Materials other than Boraflex	

During the audit of program elements 1–6, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). Although the applicant did not provide plant-specific operating experience for staff review, it provided documentation demonstrating that industry operating experience is evaluated and incorporated into this program element. The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.M40.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B2.1.39, Metal Enclosed Bus

Summary of Information in the Application. The LRA states that AMP B2.1.39, “Metal Enclosed Bus,” is a new program that is consistent with the program elements in GALL Report AMP XI.E4, “Metal Enclosed Bus.” To verify this claim of consistency, the staff audited the LRA AMP.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of metal enclosed bus providing power to the service water pumps. The staff also conducted an independent search of the applicant’s operating experience database using the keywords: “bus insulation,” “loose connection,” “corrosion,” and “cracking.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B2.1.39	Metal Enclosed Bus	Revision 3
2. EDP-xx-nnnnn	Metal Enclosed Bus Clean and Inspect	Revision 0b
3. CARS 200909297	Operating Experience Report for AMP B2.1.39	04/29/2012
4. CARS 200508906	Operating Experience Report for AMP B2.1.39	05/11/2010
5. CARS 201203319	Bird Nest Identified in S/U Transformer Overhead Cable Tray	05/01/2012

During the audit of program elements 1–6, the staff found that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding element(s) of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage the effects of aging.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP XI.E4.

Based on this audit the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, when implemented by the applicant, will be sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B3.1, Fatigue Monitoring

Summary of Information in the Application. The LRA states that AMP B3.1, “Fatigue Monitoring,” is an existing program with enhancements that is consistent with the program elements in GALL Report AMP X.M1, “Fatigue Monitoring.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant’s operating experience database using keywords: “cycle,” “fatigue,” and “cyclic.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B3.1	Fatigue Monitoring	Revision 3, 11/28/2011
2. EDP-ZZ-01123	FatiguePro Cycle/Transient Monitoring	Revision 2
3. ETP-ZZ-01002	Tracking Transients and Usage Factors	Revision 6
4. APA-ZZ-00600	Design Change Control	Revision 42
5. ZZ-006	Engineering Changes	Revision 30, 06/24/2011
6.	Operating Experience Summary Report – Fatigue Monitoring (Industry and CAR)	
7. CAR No. 200602827	Feedwater Isolation Valve Rupture Discs Leaking	
8. CAR No. 200810394	Surge Line Delta T Exceeded 80 °F	
9. CAR No. 200909691	Operational Enhancement: Switch to Alternate Charging in Cycle 18	

Document	Title	Revision/Date
10. CAR No. 201103192	Evaluate 120 gpm Letdown Flow on Charging Lines Fatigue Design	
11. CAR No. 201102233	Normal 120 gpm CVCS Letdown Flow outside CVCS Fatigue Design Basis	
12. FP-CALL-304	Baseline Analysis of Callaway Plant Cycles and Fatigue Usage – Startup through 1/31/2011	Revision 1, 10/13/2011
13. CAR No. 201102470	Indeterminate Document Requirements for Shared Components – for shared Non-ASME and ASME Section III Components and Parts	
14. Specification No. S-1068 (Q)	Technical Specification for Pressurizer Safety Valve and RHR Pump Suction Relief Valve Testing and Refurbishment	Revision 4, 03/09/2009
15. CN-SEE-III-11-30	Callaway CVCS Heat Exchangers Revised Transients: Fatigue, Flow Velocity, and Pressure Drop Evaluations	Revision 1, 11/23/2011
16. FP-CALL-307	Environmentally Assisted Fatigue Screening	Revision 2, 04/30/2012
17. FP-CALL-310	Benchmarking of Charging Nozzle Stress-Based Fatigue	Revision 0, 06/22/2011
18. CAR No. 201106192	Excess Letdown Heat Exchanger Fatigue Design Basis Transient Issue	
19. CAR No. 200703155	Pressurizer Cooldown Limit Exceeded When Taking the Pressurizer Solid	
20. FP-CALL-402	System Review and Recommendations for a Fatigue Management Program at Callaway Plant Unit 1	Revision 2, 11/23/2010
21. FP-CALL-405	Cycle Counting Methodology Report for the Transient and Fatigue Monitoring System for Callaway Plant	Revision 0, 04/29/2011
22. Job 08501202-330	Certificate of Conformance of Work Performed for Wolf Creek and Callaway – Purchase Order #745261	01/16/2010

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program as modified by the proposed enhancements.

During the audit, the staff verified that the “scope of program,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria” and “corrective actions” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP. In addition, the staff found that for the “preventive actions” and “parameters monitored or inspected” program elements, sufficient information was not available to determine if they were consistent with the corresponding program elements of the GALL Report AMP. To obtain the information necessary to verify if these program elements are consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing RAIs for the subjects discussed below.

The “preventive actions” program element of the LRA AMP provides an enhancement, which states that “[p]rocedures will be enhanced to 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.” The GALL Report AMP recommends ensuring that the actual transient severity does not exceed the bounds of the design transient definitions. The staff noted that ensuring that the design severity of a transient is not exceeded during

plant operation is an essential part of a Fatigue Monitoring Program; therefore, considering this enhancement to the applicant's existing program, it is not clear to the staff how the applicant ensured that the accumulated transients from initial plant startup until the procedures are enhanced will be bound by the design transients.

The "parameters monitored or inspected" program element of the LRA AMP provides an enhancement, which states that "[p]rocedures will be enhanced to include additional transients that contribute significantly to fatigue usage identified by evaluation of ASME Section III fatigue and fatigue crack growth analyses." The GALL Report AMP recommends the program monitor all plant design transients that cause cyclic strains, which are significant contributors to the fatigue usage factor. It is not clear to the staff that these statements are consistent, because in contrast, LRA Section 4.3.1 states that this review of the design and licensing analyses has already been performed. Therefore, it is not clear to the staff what will be enhanced in the procedures.

During the audit of the "operating experience" program element, the staff determined that the operating experience provided by the applicant and identified by the staff's independent database search is not bounded by industry operating experience. The staff also determined that the operating experience provided by the applicant and identified by the staff's independent database search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. To obtain the information necessary to determine if the applicant's operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing an RAI for the subject discussed below.

Regulatory Issue Summary (RIS) 2011-14, "Metal Fatigue Analysis Performed by Computer Software," was issued on December 29, 2011. The staff noted that documentation of how the applicant addressed the recently issued RIS was not available to the staff during its audit; therefore, it is not clear if and how the applicant will address the issues discussed in RIS 2011-14.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff found that sufficient information was not available to determine whether the description provided in the FSAR supplement was an adequate description of the LRA AMP. To obtain the information necessary to verify the sufficiency of the FSAR supplement program description, the staff will consider issuing an RAI for the subject discussed below.

The applicant's FSAR supplement in LRA Section A2.1 does not include a general description, or discuss how the monitoring methods will manage cumulative fatigue damage during the period of extended operation.

Audit Results. Based on this audit, the staff verified that LRA program elements "scope of program," "detection of aging effects," "monitoring and trending," "acceptance criteria," and "corrective actions" are consistent with the corresponding program elements in GALL Report AMP X.M1. The staff's evaluation of aspects of the program elements associated with enhancements that are not necessary for consistency will be addressed in the SER. The staff also identified certain aspects of LRA program elements "preventive actions" and "parameters monitored or inspected" that will require additional information or evaluation before consistency can be determined.

Based on this audit, the staff also identified that additional information about operating experience is required before a determination can be made about the sufficiency of the LRA AMP to detect and manage the effects of aging. In addition, the staff identified a need for additional information regarding the adequacy of the program description in the FSAR supplement.

LRA AMP B3.2, Environmental Qualification (EQ) of Electric Components

Summary of Information in the Application. The LRA states that AMP B3.2, “Environmental Qualification (EQ) of Electric Components,” is an existing program that is consistent with the program elements in GALL Report AMP X.E1, “Environmental Qualification (EQ) of Electric Components.” To verify this claim of consistency, the staff audited the LRA AMP. Issues identified but not resolved in this report will be addressed in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also conducted an independent search of the applicant’s operating experience database using the keywords: “cable” and “corrosion.”

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff’s search of the applicant’s operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B3.2	Environmental Qualification (EQ) of Electric Components Program	Revision 2, 10/04/2011
2. 201104724	Callaway Action Request System – Action Request	06/08/2011
3. 200904936	Callaway Action Request System – “Area 5 Steam Tunnel Enclosure Temperature is High	06/21/2009
4. 200407904	Callaway Action Request System – “Evaluate Bringing EQ Program to EPEG 05-04 Standards	10/15/2004
5. EQCN #91-02	Equipment Environmental Qualification Evaluation Check Sheet – Pressure Transmitters (Inside Containment)	Revision 2, 06/03/1991
6. 200906638	Callaway Action Request System – “RIS 2005-20 First Available Opportunity Documentation – Job W238147	08/25/2009
7. EQ CN #91-02	Equipment Qualification Change Notice	05/23/1991
8. CA1339	Licensing Impact Review – Modification Package 00-1013, RSG Component	Revision A, 02/21/2006
9. MP 08-0035 / 000.1	Install Additional Emergency Lights for Post Fire Safe Shutdown	10/06/2009

During the audit of program elements 1–6, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent

database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff's independent database search is not sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. To obtain the information necessary to determine if the applicant's operating experience supports the sufficiency of the LRA AMP, the staff will consider issuing RAIs for the subject discussed below.

Identify schedules or frequencies for publishing health reports, self-assessments, or benchmark report evaluations of the EQ program and to provide additional operating experience that demonstrates the effectiveness of the EQ program.

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," and "acceptance criteria" are consistent with the corresponding program elements in GALL Report AMP X.E1.

Based on this audit, the staff also identified that additional information about operating experience is required before a determination can be made about the sufficiency of the LRA AMP to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

LRA AMP B3.3, Concrete Containment Tendon Prestress

Summary of Information in the Application. The LRA states that AMP B3.3, "Concrete Containment Tendon Prestress," is an existing program with enhancements that is consistent with the program elements in GALL Report AMP X.S1, "Concrete Containment Tendon Prestress." To verify this claim of consistency, the staff audited the LRA AMP. The scope of this audit report includes enhancements necessary to make the LRA AMP consistent with the corresponding GALL Report AMP. However, it does not consider the sufficiency of enhancements that are not necessary for consistency; these will be evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant's staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of the auxiliary building, tendon gallery, turbine building, and the exterior of the containment structure. The staff also conducted an independent search of the applicant's operating experience database using keywords: "concrete," "tendon," and "prestress."

The table below lists the documents that the staff reviewed and found to be relevant to the audit. The applicant provided these documents or they were identified in the staff's search of the applicant's operating experience database.

Relevant Documents Reviewed

Document	Title	Revision/Date
1. CW-AMP-B3.3	Concrete Containment Tendon Prestress	Revision 2, 02/15/2011
2. ESP-ZZ-01012	Containment Post Tensioning System Inspection	Revision 8
3. C-1003(Q)	Specification for Inservice Inspection of the Containment Building Post-Tensioning System and Exterior Concrete Shell	Revision 12
4. APA-ZZ-00500	Corrective Action Program	Revision 53
5. C-01-114-F Bechtel TR	Minimum Tendon Lift-Off Forces for Inservice Surveillance	Revision 0, 01/11/1984
6. FSAR – CW SP 16.6.1.2.1	Containment Vessel Structural Integrity LCO Surveillance Requirements	Revision OL-17, April 2009
7. CAR 200902154	ASME Section XI Subsection IWL Requirements Were Not Fully Met for the 20th Year Tendon Surveillance	Revision 0, 11/18/2010
8. CAR 201009713	No Documentation Could Be Found indicating Callaway Evaluated NRC IN 99-10	Revision 0, 03/10/2011
9. CAR 200806266	Chemical Seeping from CTMT Wall inside Tendon Access Gallery	07/02/2008
10. CAR 200806266 Action 1	Document Results of Sample by Outside Lab	07/31/2008
11. CAR 200806266 Action 2	Evaluate Structural Integrity of Tendon Room Wall due to Leak	07/31/2008
12. CA-N1042-500	Callaway 25th Year Tendon Surveillance Final Report for the 25th Year Tendon Surveillance	Revision 0, 09/16/2010
13. CAR 201009644	Year 3 Tendon Data Missing	Revision 0, 10/07/2010
14. Unknown	25th Year Regression Analysis with 3rd Year results Included	
15. CAR 201000189 Action 7	Simple Self-Assessment Report SA10-ES-S02: Containment Post Tensioning System (APA-ZZ-01400 Appendix A)	Revision 9
16. CAR 201009755	Eval NRC IN 1999-10 Revision 1- Degradation of Prestressing Tendon Systems	Revision 0, 10/12/2010
17. C-0101(Q)	Bechtel SNUPPS, Reactor Building, Prestressing Requirements, Typical Details	Revision 6, 07/10/1981
18. C-0102(Q)	Bechtel SNUPPS, Reactor Building, Prestressing Requirements, Wall Details	Revision 2, 12/31/1975
19. C-0103(Q)	Bechtel SNUPPS, Reactor Building, Prestressing Requirements, Equipment Hatch Details	Revision 2, 12/31/1975
20. C-0104(Q)	Bechtel SNUPPS, Reactor Building, Prestressing Requirements, Personnel Hatch Details	Revision 6, 07/10/1981
21. C-0105(Q)	Bechtel SNUPPS, Reactor Building, Prestressing Requirements, Developed Tendon Layout	Revision 2, 03/22/1974
22. C-01-301	Inland Ryerson – Bechtel SNUPPS, Vertical Sheathing and Trumplate Location 90 to 270	Revision J, 08/23/1977
23. C-01-302	Inland Ryerson – Bechtel SNUPPS, Vertical Sheathing and Trumplate Location 270 to 90	Revision J, 08/23/1977
24. C-01-305	Inland Ryerson – Bechtel SNUPPS, Wall Tendon Development Elevation	Revision S, 03/26/1979
25. C-01-309	Inland Ryerson – Bechtel SNUPPS, Section Details of Equipment Hatch Thickened Wall at 128	Revision J, 10/10/1977

Document	Title	Revision/Date
26. C-01-314	Inland Ryerson – Bechtel SNUPPS, Dome Tendon Development	Revision L, 08/30/1978
27. C-01-318	Inland Ryerson – Bechtel SNUPPS, Developed Dome Tendon Plan (Partial)	Revision N, 01/23/1980
28. C-01-320	Inland Ryerson – Bechtel SNUPPS, Dome Buttress Sections	Revision C, 08/23/1977
29. C-01-321	Inland Ryerson – Bechtel SNUPPS, Post Tensioning Sequence	Revision H, 01/05/1981
30. C-01-303	Inland Ryerson – Bechtel SNUPPS, Base Slab Gallery and Drain Details	Revision J, 11/03/1977
31. C-01-304	Inland Ryerson – Bechtel SNUPPS, Key Plan, Buttress and Tendon Details	Revision D, 08/23/1977
32. CW Portal 50212 Pictures 1-35	Walkdown – Containment Structure	05/02/2012

The staff conducted its audit of LRA program elements 1–6, based on the contents of the existing program as modified by the proposed enhancements.

During the audit, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements of the LRA AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff determined that the operating experience provided by the applicant and identified by the staff’s independent database search is bounded by industry operating experience (i.e., the applicant or the staff did not identify any previously unknown aging effects). The staff also determined that the operating experience provided by the applicant and identified by the staff’s independent database search is sufficient to allow the staff to verify that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging

The staff also audited the description of the LRA AMP provided in the FSAR supplement. The staff verified that this description is consistent with the description provided in the SRP-LR.

Audit Results. Based on this audit, the staff verified that LRA program elements “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” are consistent with the corresponding program elements in GALL Report AMP X.S1.

Based on this audit, the staff also verified that the operating experience is sufficient to indicate that the LRA AMP, as implemented by the applicant, is sufficient to detect and manage the effects of aging. In addition, the staff verified that the description provided in the FSAR supplement is consistent with the description provided in the SRP-LR.

August 9, 2012

Mr. Adam C. Heflin
Senior Vice President and Chief
Nuclear Officer
Union Electric Company
P.O. Box 620
Fulton, MO 65251

SUBJECT: AGING MANAGEMENT PROGRAMS AUDIT REPORT REGARDING THE
CALLAWAY PLANT UNIT 1 LICENSE RENEWAL APPLICATION (TAC
NO. ME7708)

Dear Mr. Heflin:

By letter dated December 15, 2011, Union Electric Company d/b/a Ameren Missouri (the applicant) submitted an application for renewal of operating license NPF-30 for the Callaway Plant Unit 1 (Callaway). On May 10, 2012, the staff of the U.S. Nuclear Regulatory Commission (NRC or the staff) completed the on-site audit of aging management programs. The audit report is enclosed.

If you have any questions, please contact me by telephone at 301-415-2946 or by e-mail at Samuel.CuadradoDeJesus@nrc.gov.

Sincerely,

/RA/

Samuel Cuadrado de Jesús, Project Manager
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosure:
As stated

cc w/encl: Listserv

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DATE	07/31/2012	07/03/2012	08/07/2012	08/09/2012

OFFICIAL RECORD COPY

Letter to Adam C. Heflin from Samuel Cuadrado de Jesús dated August 9, 2012.

SUBJECT: AGING MANAGEMENT PROGRAMS AUDIT REPORT REGARDING THE
CALLAWAY PLANT UNIT 1 LICENSE RENEWAL APPLICATION (TAC
NO. ME7708)

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