



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

January 29, 2018

Mr. William F. Maguire  
Site Vice President  
River Bend Station, Unit 1  
Entergy Operations, Inc.  
5485 U.S. Highway 61 N  
St. Francisville, LA 70775

SUBJECT: AGING MANAGEMENT PROGRAMS AUDIT REPORT REGARDING  
RIVER BEND STATION, UNIT 1, LICENSE RENEWAL APPLICATION REVIEW  
(CAC NO. MF9757)

Dear Mr. Maguire:

By letter dated May 25, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17153A282), Entergy Operations, Inc. (the applicant) submitted an application under Title 10 of the *Code of Federal Regulations* Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," to renew Operating License NPF-47 for River Bend Station, Unit 1 (RBS). On November 9, 2017, the NRC staff completed both the in-office and the onsite audit of aging management programs for the RBS license renewal. I have enclosed the audit report.

If you have any questions, please contact me by telephone at 301-415-4084 or by e-mail at [Emmanuel.Sayoc@nrc.gov](mailto:Emmanuel.Sayoc@nrc.gov).

Sincerely,

**/RA/**

Emmanuel Sayoc, Project Manager  
License Renewal Project Branch  
Division of Materials and License Renewal  
Office of Nuclear Reactor Regulation

Docket No. 50-458

Enclosure:  
Audit Report

cc: Listserv

SUBJECT: AGING MANAGEMENT PROGRAMS AUDIT REPORT REGARDING RIVER BEND STATION, UNIT 1, LICENSE RENEWAL APPLICATION REVIEW (CAC NO. MF9757)

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U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION, DIVISION OF MATERIALS AND LICENSE  
RENEWAL

Docket No: 50-458

License No: NPF-47

Licensee: Entergy Operations, Inc.

Facility: River Bend Station, Unit 1

Location: St. Francisville, LA

Dates: October 16–November 8, 2017

Reviewers: E. Sayoc, Project Manager, Division of Materials and License Renewal (DMLR)  
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ENCLOSURE

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## Introduction

The U.S. Nuclear Regulatory Commission (NRC or the staff) conducted a 4-week, in-office and onsite audit at the River Bend Station, Unit 1 (RBS), nuclear power plant in St. Francisville, LA, from October 16, 2017, to November 8, 2017. NRC staff conducted an in-office document review before and after the onsite audit. The purpose of the audit was to examine Entergy Operations, Inc.'s (Entergy's or the applicant's) aging management programs (AMPs) and related documentation to verify the applicant's claims of consistency with the corresponding AMPs in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report—Final Report," Revision 2, issued 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
- 10) operating experience

As part of its review of the RBS license renewal application (LRA), the staff will separately evaluate exceptions to the GALL Report AMP elements. The staff will document this separate evaluation in the safety evaluation report (SER).

NUREG-1800, "Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants," Revision 2, issued December 2010 (SRP-LR), provides staff guidance for reviewing a license renewal application. The SRP-LR allows an applicant to reference in its license renewal application 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 should document this determination in an auditable form and maintain the documentation onsite.

During the audit, the staff audited Program Elements 1 through 6 and Program Element 10 of each aging management program (i.e., "scope of program," "preventive actions," "parameters monitored or inspected," "detection of aging effects," "monitoring and trending," "acceptance

criteria,” and “operating experience”). These program elements of the applicant’s AMPs were claimed to be consistent with the GALL Report. Unless otherwise indicated in the audit report, the staff audited these program elements against the related elements of the associated AMP described in the GALL Report. The staff audited Program Elements 7 through 9 (i.e., “corrective actions,” “confirmation process,” and “administrative controls”) during the scoping and screening methodology audit conducted October 23-26, 2017. The staff will evaluate Program Elements 7, 8, and 9 separately. The staff audited all AMPs that the applicant stated were consistent with the GALL Report AMPs.

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

In performing the audit, the staff examined the applicant’s LRA, program basis documents, and related references; interviewed various applicant representatives; and conducted walkdowns of several plant areas. In total, the NRC staff reviewed 46 AMPs and conducted 58 breakout (discussion) sessions with applicant representatives. This report documents the staff’s activities during the audit.

**License Renewal Application AMP B1.1, “Aboveground Metallic Tanks”**

Summary of Information in the Application. The license renewal application states that AMP B1.1, “Aboveground Metallic Tanks,” is a new program that will be consistent with the program elements in GALL Report AMP XI.M29, “Aboveground Metallic Tanks,” as modified by LR-ISG-2012-02, “Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion under Insulation.” To verify this claim of consistency, the staff audited the LRA aging management program. Any issues that staff identified but does not resolve in the report, staff will address in the safety evaluation report (SER).

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that that staff reviewed and found relevant to the audit. The applicant provided these documents.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
RBS-EP-15-00007	Aging Management Program Evaluation Results non-Class 1 Mechanical – Aboveground Metallic Tanks	Revision 0
RBS-EP-15-00003	Operating Experience Review Results – Aging Management Program Effectiveness	Revision 1
BOP-VE-14-041	Inspection Report for CNS-TK1 Interior Inspection Below the Waterline	11/20/2014
237.300	Specification for Field Fabricated Aluminum Tanks	06/04/1985
12210-EC-55E-3	Condensate Tank Foundations Plans and Details	Revision 3

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

In addition, the staff found that for the “preventive actions,” and “detection of aging effects,” program elements, there was insufficient information to determine whether these program elements are consistent with the corresponding program elements of the GALL Report AMP. In order to verify whether these program elements are consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing an RAI. Specifically, the RAI will request information for the subject discussed below.

The “preventive actions” program element of the license renewal application AMP states that a protective multilayer vapor barrier beneath the condensate storage tank (CST) serves as a seal at the concrete-to-tank interface. The “detection of aging effects” program element of the GALL Report AMP recommends that periodic visual inspections are conducted of the sealant or caulking (in this case, the vapor barrier) at the interface between the tank and the concrete. It is not clear to the staff that these statements are consistent because based on a review of Specification 237.300, it is not clear that the vapor barrier is adequate to seal the tank-to-concrete interface. During the audit, the staff did not identify any plant-specific procedures requiring an inspection of the multilayer vapor barrier interface with the concrete foundation for the condensate storage tank.

During the audit, the staff observed:

- The staff reviewed Specification 237.300 and verified that most of the condensate storage tank is constructed from ASTM B209, “Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate,” Brade 5454-0 material. The staff noted that for the remaining parts, the nozzle necks were constructed of ASTM B241, “Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube,” Grade 6061-T6 material and the nozzle flanges were constructed of ASTM B247, “Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings,” Grade 6061-T6 material. Based on the its review of NUREG-2192, “Standard Review Plan for Review of Subsequent License Renewal Applications for Nuclear Power Plants,” Section 3.2.2.2.8, “Cracking due to Stress Corrosion Cracking in Aluminum Alloys,” the staff confirmed that aluminum alloy and temper combinations including 6061-T6x are not susceptible to stress corrosion cracking.
- The staff reviewed Specification 237.300, Section 5, “Procedure for Installing Vapor Barrier,” and verified that the specification requires that the following procedures be applied to the concrete foundation in contact with the bottom of the aluminum tank:
  - 1) apply an asphalt primer to the concrete
  - 2) on top of the primer, install Celotex ® Elastibord (with butt joints sealed with asphalt)
  - 3) on top of the Celotex ® Elastibord, install three layers of 15-pound roofing felt (with staggered overlap on joints) with asphalt sealer
  - 4) install another layer of Celotex ® Elastibord as stated in (2)
  - 5) install a layer of Pyrotex ® fiber Z-5 with asphalt sealer

Specification 237.300, Section 5, also specifies all inside and outside edges of the composite vapor material should be sealed with hot asphalt “to the surface.”

- The staff reviewed 12210-EC-55E-3, Detail D, and noted that there is an internal lip on the inside ring of the condensate storage tank foundation where water could accumulate through the thickness of sand.

During the audit of the “operating experience” program element, the staff’s independent database search did not identify any operating experience that would indicate that the AMP may be inadequate to manage the associated aging effects. In the SER, the staff will address its evaluation of the identified plant-specific operating experience.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff found insufficient information to determine whether the updated safety analysis report supplement’s description was an adequate description of the LRA aging management program. In order to verify the sufficiency of the updated safety analysis report supplement program description, the staff will consider issuing an RAI for the subject discussed below.

- GALL Report AMP XI.M29, as modified by LR-ISG-2012-02, Table 3.0-1, “FSAR Supplement for Aging Management of Applicable Systems,” states that periodic visual inspections should be conducted to monitor the condition of the caulking or sealant (i.e., in this case, the vapor barrier interface between the condensate storage tank sides and concrete foundation) installed at the condensate-storage-tank-to-concrete foundation interface. LRA Section A.1.1 does not state that the applicant will conduct periodic visual inspections to monitor the condition of the caulking or sealant (i.e., in this case, the vapor barrier interface between the condensate storage tank sides and concrete foundation) installed at the condensate-storage-tank-to-concrete foundation interface. The licensing basis for this program for the period of extended operation may not be adequate if the applicant does not incorporate these inspections into the updated safety analysis report supplement for the Aboveground Metallic Tanks Program.

#### **LRA AMP B.1.1, “Aboveground Metallic Tanks,” Onsite Audit**

Audit Activities. During its onsite audit, the staff conducted a walkdown of the condensate storage tank and made the following observations:

- the vapor barrier installed between the tank bottom and concrete/sand bed extends approximately 4 inches beyond the side of the tank, except in very limited locations;
- the upper layer of the vapor barrier is severely weathered with fibers showing;
- there is evidence of delamination between layers of the vapor barrier; and
- approximately 40 percent of the perimeter of the tank is adjacent to a curb that could allow water to accumulate above the height of the vapor barrier.



**License Renewal Application AMP B.1.2, “Bolting Integrity”**

Summary of Information in the Application. The LRA states that AMP B.1.2, “Bolting Integrity,” is an existing program with enhancements and exceptions that will be consistent with the program elements in GALL Report AMP XI.M18, “Bolting Integrity.” To verify this claim of consistency, the staff audited the LRA aging management program. Any issues the staff identified, but did not resolve in this report, the staff will address in the SER. During the audit, the staff reviewed the exceptions and enhancements associated with this AMP. Staff will evaluate the exceptions to the GALL Report AMP and the enhancements in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
RBS-EP-15-00007	Aging Management Program Evaluation Report Non-Class 1 Mechanical-Bolting Integrity	Revision 0
RBS-EP-15-00003	Operating Experience Review Results-Aging Management Program Effectiveness	Revision 1
ADM-0047	Leakage Reduction and Monitoring Program	Revision 7
CEP-NDE-0901	VT-1 Examination (Entergy Nuclear Engineering Programs)	Revision 4
CEP-NDE-0902	VT-2 Examination (Entergy Nuclear Engineering Programs)	Revision 7
CEP-RR-001	ASME Section XI Repair/Replacement Program	Revision 311
EN-DC-178	System Walkdowns	Revision 7
EN-MA-145	Maintenance Standard for Torque Applications	Revision 7
ENG-3-043	RBS Section XI Pressure Test Program	Revision 9
WO 503551135-01	Clean Inspect Strainer	08/01/2014
EN-EV-112	Chemical Control Program	Revision 16
EN-DC-150	Condition Monitoring of Maintenance Rule Structures	Revision 9

During the audit, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” and “acceptance criteria” program elements of the LRA aging management program 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, there was insufficient information to determine whether the “detection of aging effects,” was consistent with the corresponding program element of the GALL Report AMP. In order to verify

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

- The LRA aging management program states an exception to the “detection of aging effects” program element. The exception states that submerged pressure closure bolting will be inspected at least once every 10 years instead of at least once every refueling cycle. The GALL Report AMP XI.M18, “detection of aging effects” program element recommends periodic inspections (at least once per refueling cycle) of closure bolting for signs of leakage to ensure the detection of age-related degradation due to loss of material and loss of preload. During the audit, the staff reviewed the LRA and program basis documents and noted that the applicant’s program information was not clear regarding the following information: (1) where the submerged closure bolts are located, (2) what the sample size of submerged bolts to be inspected is, and (3) how inspections of the submerged bolting will be performed to detect the applicable aging effects at each of the submerged bolt locations. The staff notes that a submerged environment limits the ability to perform inspections and detect leakage of submerged bolted connections; therefore, it is not clear how the submerged closure bolting will be inspected such that loss of material and loss of preload can be detected prior to loss of intended function consistent with the GALL Report AMP “detection of aging effects” program element.
- The LRA aging management program states an enhancement to the “detection of aging effects” program element. The enhancement states that the Bolting Integrity AMP procedures will be revised to “specify visual inspection of a representative sample of closure bolting (bolt heads, nuts, and threads) in air environments.” The enhancement also states that a representative sample of 20 percent of the population, but no more than 25 fasteners for each material/environment combination, will be inspected each 10-year period during the period of extended operation. It is not clear if this enhancement applies to closure bolting that is exposed to an external air environment or if it applies to closure bolting of systems that contain clear gaseous fluids (i.e., have an internal air environment). The “detection of aging effects” program element of GALL Report AMP XI.M18 recommends periodic visual inspections (at least once per refueling cycle) of closure bolting for signs of leakage to ensure the detection of age-related degradation due to loss of material and loss of preload. The LRA credits the Bolting Integrity Program to manage closure bolting of systems that contain clear gaseous fluids. The staff notes that it is difficult to visually detect leakage of clear gaseous fluid. Considering this difficulty, it is not clear to NRC staff how, before there is an intended loss of function, the applicant will be able to detect signs of leakage of systems with clear gaseous fluids on the related closure bolting. How will the applicant ensure the detection of age-related degradation due to loss of material and loss of preload in these cases?

During the audit of the “operating experience” program element, the staff’s independent database search did not identify any operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects.

The staff also audited the UFSAR supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

### License Renewal Application AMP B.1.3, “Boraflex Monitoring”

Summary of Information in the Application. The LRA states that AMP B.1.3, “Boraflex Monitoring,” is an existing program with enhancement that will be consistent with the program elements in GALL Report AMP XI.M22, “Boraflex Monitoring.” To verify this claim of consistency, the staff audited the LRA aging management program. The staff will address in the SER any issues that it identified but does not resolved in this report. During the audit, the staff reviewed an enhancement associated with this AMP. Staff will evaluate this enhancement in the safety evaluation report.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that the staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
CR-RBS-2003-00053	Racklife Results	01/10/2003
CR-RBS-2012-02995	Racklife Boron Loss Assumption Exceeded	05/02/2012

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 license renewal application 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, there was insufficient information to determine whether it was consistent with the corresponding program element of the GALL Report AMP. In order to verify whether 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 “parameters monitored or inspected” program element of the LRA aging management program states that boron loss can be determined by visually inspecting, weighing, or measuring material hardness of the Boraflex coupons. The LRA aging management program also states that B-10 areal density measurements are performed if the coupons indicate a loss of boron. The GALL Report AMP recommends the use of boron areal density measurements to ascertain the degree of Boraflex degradation. It is not clear to the staff that these statements are consistent because experience with Boraflex panels indicates that coupon surveillance programs are not reliable.

During the audit of the “operating experience” program element, the staff’s independent database search identified operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The SER will contain staff’s evaluation of the identified plant-specific operating experience. In light of the plant-specific operating experience, and in order to determine whether the applicant’s license renewal application AMP can be adequate to manage the associated aging effects, the staff will consider issuing RAIs for the subjects discussed below.

- Condition Report CR-RBS-2012-02995 indicates that there is insufficient data to accurately trend the degradation of Boraflex in the spent fuel pool (SFP). The data appears to be insufficient to ensure that the Boraflex panels will maintain the 5 percent subcriticality margin prior to or upon entering the period of extended operation. In addition, the criticality safety analysis (CSA) mentioned in the condition report states that

the criticality safety analysis limit of 20 percent would not be reached until at least 2020. It is not clear to the staff that the Boraflex panels will be able to maintain the subcriticality margin during the period of extended operation.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

**License Renewal Application AMP B.1.4, “Buried and Underground Piping and Tanks Inspection”**

Summary of Information in the Application. The LRA states that AMP B.1.4, “Buried and Underground Piping and Tanks Inspection,” is a new program that will be consistent with the program elements in GALL Report AMP XI.M41, “Buried and Underground Piping and Tanks,” as modified by LR-ISG-2015-01, “Changes to Buried and Underground Piping and Tanks Recommendations.” To verify this claim of consistency, the staff audited the LRA aging management program. At the time of the audit, the applicant had not yet fully developed the documents necessary to implement this new program. As a result, the staff’s audit addressed only the program elements described in the applicant’s basis document and a search of plant-specific operating experience. Any issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the NRC staff identified them in a search of the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
RBS-EP-15-00007	Aging Management Program Evaluation Results Non Class 1 Mechanical, Buried and Underground Piping and Tanks Inspection	Revision 0
RBS-EP-15-00003	Operating Experience Review Results – Aging Management Program Effectiveness, Section 3.2.2, “Buried and Underground Piping and Tanks Inspection”	Revision 1
EC-RBS-18693	Update LDT [Line Designation Table] for Location of Buried Piping	Revision 0
WO-RBS-52508341	PCS-TEST-STA1 – Record Cathodic Protection Voltage Readings	08/13/2014
WO-RBS-52576679	PCS-TEST-STA1 – Record Cathodic Protection Voltage Readings	08/19/2015
WO-RBS-52698779	PCS-TEST-STA1 – Record Cathodic Protection Voltage Readings	08/11/2016
EN-EP-S-002-MULTI	Underground Piping and Tanks General Visual Inspection	Revision 4
SEP-UIP-RBS	River Bend Station Underground Components Inspection Plan Entergy Nuclear Engineering Programs	Revision 3

Document	Title	Revision / Date
CR-RBS-2013-00122	Visual Inspection of Buried Pipe Line CNS [Condensate Makeup, Storage, and Transfer]-750-497-004	01/08/2013
CR-RBS-2012-07706	Visual Inspection of Buried Pipe Lines CNS-006-251, LWS-004-586 [Radwaste-Liquid], and IAS [Instrument Air]-001-165	12/17/2012
CR-RBS-2012-07163	Visual Inspection of Buried Pipe Line CSH [High Pressure Core Spray]-016-054	11/19/2012
CR-RBS-2013-06354	UT Examination Readings Taken on Buried Pipe Line Number CWS [Circulating Water and Auxiliaries]-020-035-4	10/02/2013
CR-RBS-2010-04298	Cathodic Protection Test Station That Had Less Than The Acceptance Criteria of -0.850 Volts	08/31/2010
CR-RBS-2014-03095	Equipment Deficiencies on The Cathodic Protection System	06/26/2014
EC-RBS-36937	Buried Pipe Inspections Fitness For Service Calculation	12/17/2014
228.150	River Bend Piping Specification for Shop-Fabricated Piping	Revision 1
228.160	River Bend Piping Specification for Field Fabrication and Erection of Piping	Revision 6

During the audit, the staff verified that the “scope of program,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements of the LRA aging management program are consistent with the corresponding elements of the GALL Report AMP. In addition, the staff found that for the “preventive actions,” “parameters monitored or inspected,” and “detection of aging effects” program elements, there was insufficient information to determine whether they were consistent with the corresponding program elements of the GALL Report AMP. In order to verify whether 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” and “detection of aging effects” program elements of the LRA aging management program recommend the following: (1) coatings are provided for the external surfaces of buried steel piping; (2) coatings are provided for the external surfaces of buried stainless steel piping based on environmental conditions (e.g., stainless steel in chloride containing environments); (3) use of Preventive Action Category F, the highest number of inspections category, for those portions of in-scope buried steel piping which cannot be classified as Category C, D, or E; and (4) one inspection per 10-year interval for stainless steel piping. The GALL Report AMP includes the same recommendations; however, it is not clear to the staff that these statements are consistent because the staff (1) could not determine whether all in-scope steel piping is coated through its review of EC-RBS-18693, and RBS Piping Specifications 228.150 and 228.160; (2) noted during its review of CR-RBS-2013-00122 that for at least portions of the stainless steel condensate makeup, storage, and transfer system piping, no coating was installed; (3) noted during its review of EC-RBS-36937

that based on the availability of soil sample parameter results, it is not clear that the soil is noncorrosive to steel because redox potential values and soil drainage assessments were not available (i.e., Preventive Action Category E may not be applicable); and (4) noted during its review of EC-RBS-36937 that it is not clear if the soil is noncorrosive to stainless steel because chloride values were not available (i.e., one inspection per 10-year interval for stainless steel piping may not be appropriate).

- The “preventive actions” and “detection of aging effects” program elements of the LRA aging management program recommend the following: (a) to prevent damage to the coating or base metal, the limiting critical potential should not be more negative than 1200 millivolts (mV) relative to a copper copper/sulfate reference electrode (CSE), instant-off; and (b) piping inspection locations are selected based on characteristics such as coating type, coating condition, cathodic protection efficacy, backfill characteristics, soil resistivity, pipe contents, and pipe function. The GALL Report AMP includes the same recommendations; however, it is not clear to the staff that these statements are consistent because during the staff’s review of WO-RBS-52508341, WO-RBS-52576679, and WO-RBS-52698779, the staff noted that test station voltage readings were as negative as approximately -1900 mV relative to a copper copper/sulfate reference electrode. It is unclear to the staff why exceeding the cathodic protection limiting potential is not a factor when determining piping inspection location.
- The “parameters monitored or inspected” program element of the license renewal application AMP states that steel components can experience stress corrosion cracking when exposed to a carbonate/bicarbonate environment depending on cathodic polarization level, temperature, and pH. The GALL Report AMP includes the same recommendations; however, it is not clear to the staff that these statements are consistent because during the staff’s review of EC-RBS-36937, WO-RBS-52508341, WO-RBS-52576679, and WO-RBS-52698779, the staff noted that: (a) soil carbonate concentrations ranged from 60 to 150 milligrams per liter; (b) soil pH ranged from 6 to 7; and (c) test station voltage readings ranged from approximately +0.1 to -1.9 volts direct current (VDC) relative to a copper copper/sulfate reference electrode. The staff noted that based on its review of soil corrosivity testing and cathodic protection surveys, it is unclear why cracking is not an aging effect requiring management for steel piping exposed to soil.

During the audit the staff observed:

- The staff reviewed EC-RBS-18693 and noted that Attachment 9.4, “Buried Piping and Tanks Inspection and Monitoring Program,” states that portions of the external surfaces of fire protection–water piping are not coated.
- The staff reviewed WO-RBS-52508341, WO-RBS-52576679, and WO-RBS-52698779 and noted: (a) Section 7, “Acceptance Criteria,” stated that test station voltage readings should be -0.850 VDC or more negative relative to a copper copper/sulfate reference electrode; and (b) test station voltage readings ranged from approximately +0.1 to 1.9 VDC relative to a copper copper/sulfate reference electrode. The staff noted that WO-RBS-52508341, WO-RBS-52576679, and WO-RBS-52698779 did not specify if cathodic protection readings were instant-on or instant-off measurements; however, LRA Section A.4, “License Renewal Commitment List,” contains a commitment to implement the Buried and Underground Piping and Tanks Inspection Program as described in LRA Section A.1.4, “Buried and Underground Piping and Tanks Inspection,” which states, “[f]or steel components, where the acceptance criteria for effectiveness of

cathodic protection is other than -850 mV instant-off, loss-of-material rates are measured.”

- The staff reviewed EN-EP-S-002-MULTI and noted that bare metal inspections of components are (a) performed with sufficient illumination and resolution to assess the component for indications of cracking; (b) conducted by personnel having an annual eye examination and visual acuity specified in CEP-NDE-100, “Administration and Control of NDE,” and/or ASME Code Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components,” IWA-2321, “Vision Tests;” and (c) conducted by personnel who are VT-1 qualified.
- The staff reviewed CR-RBS-2013-00122 and noted that no external coating was identified during a visual inspection of buried pipe line number CNS-750-497-004. The staff also noted CR-RBS-2013-00122 stated that coating should have been required for the line and that the line had surface rust and no through-wall leakage.
- The staff reviewed CR-RBS-2012-07706 and noted that during a visual inspection of buried pipe line numbers CNS-006-251, LWS-004-586, and IAS-001-165, inspections found that coating was missing on numerous areas of stainless steel pipe (for lines CNS-006-251 and LWS-004-586) and coating was missing on a 1-inch by 3-inch location on the carbon steel pipe (for line IAS-001-165). The staff also noted that CR-RBS-2012-07706 stated that the missing coating appeared to be from the excavating process moving sand back and forth from areas around the pipe.
- The staff reviewed CR-RBS-2012-07163 and noted that during a visual inspection of buried pipe line number CSH-016-054 coating was missing on numerous areas of the pipe. The staff also noted that CR-RBS-2012-07163 stated that the condition appeared to be from the excavating process moving sand back and forth from areas around the pipe and that there were no signs of corrosion or pitting to the pipe.
- The staff reviewed CR-RBS-2013-06354 and noted that 11 out of 20 ultrasonic thickness measurement readings taken on CWS-020-035-4 were below 87.5 percent of the nominal pipe wall thickness of 0.375 inches. The staff also noted that the 11 readings below 87.5 percent of the nominal pipe wall thickness were all greater than 0.285 inches and that the minimum acceptable wall thickness to meet code requirements is 0.130 inches.
- The staff reviewed CR-RBS-2010-04298 and noted that the report stated that there were test stations that had less than the acceptance criterion of -0.850 volts.
- The staff reviewed CR-RBS-2014-03095 and noted that (a) the aggregate effect of equipment deficiencies on the cathodic protection system has resulted in portions of underground piping not being fully protected; and (b) underground piping inspections in 2013 identified some failures of the coal tar epoxy coatings, increasing the importance of the protection provided by the cathodic protection system.
- The staff reviewed EC-RBS-36937 and noted that (a) ultrasonic thickness measurement readings taken on CNS-006-251, LWS-004-586, and CSH-016-054 (buried pipe lines referenced in condition reports above) were above 87.5 percent of the nominal pipe wall thickness after 28 years; (b) soil pH ranged from 6 to 7; (c) soil resistivity at the plant ranged from 3,000 to 150,000 ohm-cm; (d) soil carbonate concentrations ranged from 60 to 150 milligrams per liter; and (e) soil sulfides were less than 5 milligrams per liter.
- The staff reviewed RBS Piping Specifications 228.150 and 228.150, and noted that underground carbon and low-alloy steel piping are specified to have exterior surfaces

coated and are wrapped where called for in the specification or on the piping arrangement drawings.

During the audit of the “operating experience” program element, the staff’s independent database search did not identify any operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. In the SER, the staff will discuss its evaluation of the identified plant-specific operating experience.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR, as modified by LR-ISG-2015-01.

**License Renewal Application AMP B.1.5, “BWR Control Rod Drive Return Line Nozzle”**

Summary of Information in the Application. The LRA states that AMP B.1.5, “BWR Control Rod Drive [CRD] Return Line Nozzle,” is an existing program that will be consistent with the program elements in GALL Report AMP XI.M6, “BWR Control Rod Drive Return Line Nozzle.” To verify this claim of consistency, the staff audited the LRA aging management program. In the SER, staff will address issues that it identified but does not resolved in this report.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
RBS-EP-15-00006	Aging Management Program Evaluation Report Class 1 Mechanical (Section 4.1, BWR CRD Return Line Nozzle)	Revision 0
RBS-EP-15-00003	Operating Experience Review Results – Aging Management Program Effectiveness (Section 3.1.3, BWR CRD Return Line Nozzle Program)	Revision 2
SEP-ISI-RBS-001	Program Section for ASME Code, Section XI, Division 1 Inservice Inspection (ISI) Program	Revision 0
RBG- 47110	Inservice Inspection Plan for the Third 10-Year Interval	1/17/2011

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 aging management program are consistent with the corresponding elements of the GALL Report AMP.

In addition, the staff found that, for the “scope of program” program element, there was insufficient information to determine whether it was consistent with the corresponding program element of the GALL Report AMP. In order 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 subjects discussed below.

- The “scope of program” program element of the GALL Report AMP states that the scope of the program includes the control rod drive return line (CRDRL) nozzle and its nozzle-to-reactor-vessel welds which are ASME Code Class 1 components. The LRA indicates that the CRDRL nozzle design also includes a safe end between the nozzle and the cap. The LRA does not clearly indicate that the program scope includes the nozzle-to-safe-end weld.



During the audit of the “operating experience” program element, the staff’s independent database search did not identify operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff found insufficient information to determine whether the updated safety analysis report supplement description was an adequate description of the LRA aging management program. In order to verify the sufficiency of the updated safety analysis report supplement program description, the staff will consider issuing an RAI to clarify whether the scope of program includes the nozzle-to-safe-end weld, as discussed above in relation to the “scope of program” program element.

**License Renewal Application AMP B.1.6, “BWR Feedwater Nozzle”**

Summary of Information in the Application. The LRA states that AMP B.1.6, “BWR Feedwater Nozzle,” is an existing program that will be consistent with the program elements in GALL Report AMP XI.M5, “BWR Feedwater Nozzle.” To verify this claim of consistency, the staff audited the LRA aging management program.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that the staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
RBS-EP-15-00006	Aging Management Program Evaluation Report Class 1 Mechanical (Section 4.2, BWR Feedwater Nozzle)	Revision 0
RBS-EP-15-00003	Operating Experience Review Results – Aging Management Program Effectiveness (Section 3.1.3, BWR Feedwater Nozzle Program)	Revision 2
GE-NE-523-A71-0594-A	Alternate BWR Feedwater Nozzle Inspection Requirements	Revision 1
USAR	Section 5.3.3.1.4.5, Reactor Vessel Nozzles	Revision 24
SEP-ISI-RBS-001	Program Section for ASME Code, Section XI, Division 1 Inservice Inspection (ISI) Program	Revision 0
RBG- 47110	Inservice Inspection Plan for the Third 10-Year Interval	1/17/2011

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 aging management program are consistent with the corresponding elements of the GALL Report AMP.

During the audit, the applicant confirmed that, as indicated in Section 5.3.3.1.4.5 of the updated safety analysis report, the thermal sleeve/sparger design of the feedwater nozzle does not use the interference fit design that is addressed in Table 6-1 of General Electric Report GE-NE-523-A71-0594-A, Revision 1. Therefore, the staff noted that the applicant’s program, which follows the inspection frequency for feedwater nozzles per ASME Code Section XI as mandated by Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a, “Codes and

Standards,” needs no additional augmented inspections, consistent with the GE Report. The staff also noted that this aging management approach is consistent with the GALL Report AMP.

During the audit of the “operating experience” program element, the staff’s independent database search did not identify operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

**License Renewal Application AMP B.1.7, “BWR Penetrations”**

Summary of Information in the Application. The LRA states that AMP B.1.7, “BWR Penetrations,” is an existing program that will be consistent with the program elements in GALL Report AMP XI.M8, “BWR Penetrations.” To verify this claim of consistency, the staff audited the LRA aging management program.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists documents that the NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
1. RBS B.1.7	Program Basis Document, License Renewal Program Book – BWR Penetrations	Revision 0
2. EN-FAP-LR-007	Evaluation of Aging Management Programs	Revision 6
3. CR-RBS-2002-01401	Enhanced VT-2 on Weld, and Accessibility Issues	03/27/2003
4. CR-RBS-2017-06676	Inspection of Nozzle to Vessel Weld Cannot Be Confirmed	09/13/2017

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 license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff’s independent database search did not identify any operating experience that would indicate that the AMP may be inadequate to manage the associated aging effects.

The staff also audited the updated safety analysis report supplement’s description of the license renewal application AMP. The staff verified that the updated safety analysis report supplement description is consistent with the SRP-LR description.

**License Renewal Application AMP B.1.8, “BWR Stress Corrosion Cracking”**

Summary of Information in the Application. The license renewal application states that AMP B.1.8, “BWR Stress Corrosion Cracking,” is an existing program that will be consistent with the program elements in GALL Report AMP XI.M7, “BWR Stress Corrosion Cracking.” To verify this claim of consistency, the staff audited the LRA aging management program. Issues that the NRC staff identified but did not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
RBS-EP-15-00006	Aging Management Program Evaluation Report Class 1 Mechanical (Section 4.4, BWR Stress Corrosion Cracking)	Revision 0
RBS-EP-15-00003	Operating Experience Review Results – Aging Management Program Effectiveness (Section 3.1.6, BWR Stress Corrosion Cracking)	Revision 2
SEP-ISI-RBS-001	Program Section for ASME Code, Section XI, Division 1 Inservice Inspection (ISI) Program	Revision 0
RBG- 47110	Inservice Inspection Plan for the Third 10-Year Interval	1/17/2011
RBG-28760	Revision 3 to the Inservice Inspection Plan for River Bend Station – Unit 1	9/2/1988
	RBS Strategic Chemistry Plan	Revision 10
CR-RBS-2010-05935	Need to Perform Additional Inspections in Order to Meet the Percentage Requirements of BWRVIP -75-A [Boiling-Water Reactor Vessel and Internals Project -75-A]	11/15/2010

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 aging management program are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff’s independent database search did not identify any operating experience that would indicate that the AMP may be inadequate to manage the associated aging effects.

The staff also audited the updated safety analysis report supplement’s description of the license renewal application AMP. The staff verified that the updated safety analysis report supplement description is consistent with the SRP-LR description.

**License Renewal Application AMP B.1.9, “BWR Vessel ID Attachment Welds”**

Summary of Information in the Application. The LRA states that AMP B.1.9, “BWR Vessel ID Attachment Welds,” is an existing program that is consistent with the program elements in GALL Report AMP XI.M4, “BWR Vessel ID Attachment Welds.” To verify this claim of consistency, the staff audited the LRA aging management program. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC 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 following keywords: BWRVIP (Boiling-Water Reactor Vessel and Internals Project), integral attachment, ID attachment, attachment weld, inservice, and inspection.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the NRC staff identified them during its search of the applicant’s operating experience database or during its review of the operating

history section in the program evaluation report for license renewal application AMP B.1.9, “BWR Vessel ID Attachment Welds.”

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
RBS License Renewal Application, Section B.1.9	BWR Vessel ID Attachment Welds	Revision 0
NUREG-1800, Chapter XI, Section (AMP) XI.M9	Generic Aging Lessons Learned (GALL) Report, AMP XI.M9, BWR Vessel ID Attachment Welds	GALL Revision 2
RBS License Renewal Application, Section 3.1 (Including LRA AMR Tables 3.1.1 and 3.1.2-1 in the Section 3.1)	Reactor Vessel Internals, and Reactor Coolant System	Revision 0
RBS License Renewal Application, Appendix A, Updated Safety Analysis Report, Section A.1, Subsection A.1.9	BWR Vessel ID Attachment Welds	Revision 0
RBS-EP-15-00006, Section 4.5	RBS License Renewal Project, Aging Management Program Evaluation Report, Class 1 Mechanical, BWR Vessel ID Attachment Welds	Revision 0
RBS-ME-15-00001	RBS License Renewal Project, Aging Management Review of the Reactor Pressure Vessel	Revision 0
EN-FAP-LR-007	Evaluation of Aging Management Programs	Revision 6, 02/18/2015
EN-FAP-LR-004	Mechanical System Screening and Aging Management Reviews	Revision 8, 08/24/2016
Updated Safety Analysis Report (USAR), Chapter 3	Design of Structures, Components, Equipment, and Systems	Revision 24
USAR Chapter 4	Reactor	Revision 24
USAR Chapter 5	Reactor Coolant System and Connected Systems	Revision 24
BWRVIP-48-A (EPRI TR No. 1009948)	BWR Vessel and Internals Project, Vessel ID Attachment Weld Inspection and Evaluation Guidelines	November 2004
Entergy Letter No. RRB-47362	Request for Alternative in Accordance with 10 CFR 50.55a(a)(3)(i), Use of Boiling Water Reactor Vessel and Internals Project (BWRVIP) Guidelines in Lieu of Specific ASME Code Requirements, River Bend Station (ML13141A257)	05/16/2013
NRC Relief Request and Safety Evaluation	River Bend Station, Unit 1 – Request for Relief No. RBS-ISI-019, Alternative to Use Boiling Water Reactor Vessel and Internals Project Guidelines in Lieu of ASME Code, Section XI Requirements for the Fourth 10-Year Inservice Inspection Interval (ML14127A327)	05/30/2014
RBS-EP-13-00004	RBS RF-17 Reactor Vessel Internals Management Program Post-Outage Report	05/13/2013
RBS-EP-15-00014	RBS RF-18 In-Vessel Visual Inspection (IVVI) Final Report	Rev. 0

Document	Title	Revision / Date
GE-Hitachi Services Information Letter (SIL) No. 658	Feedwater Sparger End Bracket Degradation	Rev. 0

During the audit, the staff found that for the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” “acceptance criteria,” and “corrective actions” program elements, there was insufficient information to determine whether they were consistent with the corresponding program elements of the GALL Report AMP. In order to verify whether these program elements are consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing RAIs for the subject discussed below.

- In the program evaluation report for the BWR Vessel ID Attachment Welds Program, the applicant identifies that the staff had granted a 10 CFR 50.55a(z)-issued ASME Section XI Code relief (ML14127A327) for the 4<sup>th</sup>, 10-year inservice inspection (ISI) interval that permits that applicant to use applicable NRC-endorsed Boiling-Water Reactor Vessel and Internals Project (BWRVIP) reports (including that in EPRI Technical Report [TR] BWRVIP-48-A (ML043290381) for BWR vessel ID attachment welds) as alternative ISI requirements for reactor vessel internals and interior attachments from those required for the components in ASME Code Section XI, Table IWB-2500-1, Examination Categories B-N-1 and B-N-2. Given that a relief request was granted for the 4<sup>th</sup>, 10-year ISI interval, the staff may request additional information regarding the specific extended period licensing basis that the staff will use to inspect the BWR vessel ID attachment welds and brackets during the 5<sup>th</sup> and 6<sup>th</sup> 10-year ISI intervals in the period of extended operation. This issue is also relevant to the updated safety analysis report supplement summary description for this AMP, as provided in Section A.1.9 of LRA Appendix A.

During the in-office teleconference on this AMP (held October 30, 2017), the staff asked the applicant whether any intent to continue use of this alternative ISI criteria would be resubmitted for the 5<sup>th</sup> and 6<sup>th</sup> ten-year ISI intervals in the period of extended operation. The applicant responded that, if they were desired for those ISI intervals, the proposed alternatives would be resubmitted for staff approval in accordance with the 10 CFR 50.55a(z) reporting requirements. Thus, the staff will not need to issue an RAI on this subject and considers this matter closed for the purposes of the audit.

During the audit of the “operating experience” program element and supporting operating experience (OE) information in supporting documents, the staff’s independent search and review of the operating experience indicates specific areas that would need to be discussed with the applicant to conclude that the AMP is adequate to manage the associated aging effects attributed to the reactor vessel internals components, or else to ensure that the program has been or will be sufficiently augmented to ensure adequate management of these aging effects. The SER will address the staff’s evaluation of the identified plant-specific operating experience; however, in light of the plant-specific operating experience, In order to determine whether the applicant’s LRA aging management program can be adequate to manage the associated aging effects, the staff will consider issuing RAIs for the subjects discussed below.

- The operating experience summaries in some condition reports (CRs) issued in the year 2014 and summarized in the program evaluation report for the AMP (i.e., CR Nos. CR-RBS-2014-00253 and CR-RBS-2014-00016) indicate that the applicant has been

performing inspections of the feedwater sparger end brackets and their pins using the guidelines in GE Services Information Letter 658, "Feedwater Sparger End Bracket Degradation," dated July 2008. The staff observed that the applicant does not clarify whether further inspections in accordance with GE Services Information Letter 658 are within the scope of the AMP. The staff will consider issuing an RAI on this topic, and whether the inspections performed under the services information letter need to be identified as an appropriate enhancement of the AMP.

- The operating experience summaries in some plant inspection reports identify some minor instances of cracking that was detected in some of feedwater sparger bracket and core spray sparger bracket welds. In Chapter 12 of ERPI Report No. BWRVIP-03, Rev. 15, EPRI provides its proprietary recommendations for performing specific types of supplemental inspections of interior attachment sparger bracket components when cracking is detected during the program's baseline inspections of the components. For flaws that were detected in the core spray or feedwater sparger brackets, the staff observed that the applicant did not specify whether the applicant had performed the supplemental inspections recommended for the components in BWRVIP-03, Rev. 15. The staff will consider issuing an RAI on this topic.

The staff also audited the updated safety analysis report supplement's description of the BWR Vessel ID Attachment Welds Program (Section A.1.9 of the updated safety analysis report supplement). The staff found insufficient information to determine whether the updated safety analysis report supplement description was an adequate description of the LRA aging management program. In order to verify the sufficiency of the updated safety analysis report supplement program description, the staff will consider issuing an RAI for one or more of the operating experience subjects discussed in the bullets above.

### **License Renewal Application AMP B.1.10, "BWR Vessel Internals"**

Summary of Information in the Application. The LRA states that AMP B.1.10, "BWR Vessel Internals," is an existing program with enhancements that will be consistent with the program elements in GALL Report AMP XI.M9, "BWR Vessel Internals." To verify this claim of consistency, the staff audited the LRA aging management program. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER. During the audit, the staff reviewed the enhancements associated with this AMP. The staff will evaluate enhancements to the BWR Vessel Internals Program in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant's staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
RBS-ME-15-00002	RBS License Renewal Project, Aging Management Review of the Reactor Vessel Internals	Revision 2, 10/20/2016
RBS-EP-15-00003	Operating Experience Review Results – Aging Management Program Effectiveness	Rev. 2, 06/20/2017
EN-FAP-LR-007	Evaluation of Aging Management Programs	Revision 6, 02/18/2015
EN-FAP-LR-004	Mechanical System Screening and Aging Management Reviews	Revision 8, 08/24/2016
RBS-EP-15-00006, Section 4.6	RBS License Renewal Project, Aging Management Program Evaluation Report, Class 1 Mechanical, BWR Vessel Internals	Revision 0
BWRVIP-18	BWR Core Spray Internals Inspection and Flaw Evaluation Guidelines	Revision 1-A
BWRVIP-25	BWR Core Plate Inspection and Flaw Evaluation Guidelines	Revision 1
BWRVIP-26-A	BWR Top Guide Inspection and Flaw Evaluation Guidelines	Revision 0
BWRVIP-27-A	BWR Standby Liquid Control/Core Plate $\Delta P$ Inspection and Flaw Evaluation Guidelines	Revision 0
BWRVIP-38	BWR Shroud Support Inspection and Flaw Evaluation Guidelines	Revision 0
BWRVIP-41	Jet Pump Assembly Inspection and Flaw Evaluation Guidelines	Revision 3
BWRVIP-42	BWR Low Pressure Coolant Injection (LPCI) Coupling Inspection and Flaw Evaluation Guidelines	Revision 1
BWRVIP-47-A	BWR Lower Plenum Inspection and Flaw Evaluation Guidelines	Revision 0
BWRVIP-74-A	BWR Reactor Pressure Vessel Inspection and Flaw Evaluation Guidelines	Revision 0
BWRVIP-75	BWR Core Shroud Inspection and Flaw Evaluation Guidelines	Revision 1-A
BWR-VIP-139-A	BWR Steam Dryer Inspection and Flaw Evaluation Guidelines (including Appendix B of the report, which was approved by NRC safety evaluation date November 8, 2016 [ADAMS ML16180A462 for the non-public proprietary FSER; and ML16180A450 for the public, non-proprietary FSER])	Revision 0
Entergy Letter No. RRB-47362	Request for Alternative in Accordance with 10 CFR 50.55a(a)(3)(i), Use of Boiling Water Reactor Vessel and Internals Project (BWRVIP) Guidelines in Lieu of Specific ASME Code Requirements, River Bend Station (ML13141A257)	05/16/2013
NRC Relief Request and Safety Evaluation	River Bend Station, Unit 1 – Request for Relief No. RBS-ISI-019, Alternative to Use Boiling Water Reactor Vessel and Internals Project Guidelines in Lieu of ASME Code, Section XI Requirements for the Fourth 10-Year Inservice Inspection Interval (ML14127A327)	05/30/2014
Engineering Document EC-0000019705	Determine an Inspection Frequency and Acceptance Criteria for Steam Dryer Upper Support Ring Indications	Rev. 00

Document	Title	Revision / Date
RBS Document SEP-RVI-003	River Bend Station Reactor Vessel Internals (RVI) Inspection Program Plan	Rev. 5
Design Document No. ER-97-0548	105% Power Uprate Evaluation Report for GE Task No. 10.6, Core Support Structure Reactor Internals Evaluation	Rev. 0, 04/02/1999
NRC Final Safety Evaluation Report	Final Safety Evaluation Report for Electric Power Research Institute Topical Report BWRVIP-183, "BWR Vessel and Internals Project, Top Guide Grid Beam Inspection and Flaw Evaluation Guidelines" (ADAMS ML15246A312 for the non-public, proprietary FSER; ML15309A275 for the publically available, non-proprietary FSER)	12/31/2015
Condition Report No. CR-RBS-2013-04927	Condition Report for the Core Shroud Assembly (See summary on page 46 of RBS-EP-15-00003)	Rev. 2, 06/20/2017 <sup>1</sup>
Condition Report No. CR-RBS-2015-01976	Condition Report for the Core Shroud H8 Horizontal Weld (See summary on page 50 of RBS-EP-15-00003)	Rev. 2, 06/20/2017 <sup>1</sup>
Condition Report No. CR-RBS-2013-05645	Condition Report for the Low Pressure Coolant Injection (LPCI) Couplings and Their Welds (See summary on page 47 of RBS-EP-15-00003)	Rev. 2, 06/20/2017 <sup>1</sup>
Condition Report No. CR-RBS-2013-04094	Condition Report for the Top Guide Assembly (See summary on page 45 of RBS-EP-15-00003)	Rev. 2, 06/20/2017 <sup>1</sup>
Condition Report No. CR-RBS-2000-00686	Condition Report for the Steam Dryer Support Ring Indications – Year 2000 Inspections (See summary on page 43 of RBS-EP-15-00003)	Rev. 2, 06/20/2017 <sup>1</sup>
Condition Report No. CR-RBS-2006-01770	Condition Report for Steam Dryer Support Ring Indications – Year 2006 Inspections (See summary on pages 43 and 44 of RBS-EP-15-00003)	Rev. 2, 06/20/2017 <sup>1</sup>
Condition Report Nos. CR-RBS-2008-00809 and CR-RBS-2008-00971	Condition Report for New Steam Dryer Bank Vertical Weld Indications – Year 2008 Inspections (See summary on page 44 of RBS-EP-15-00003)	Rev. 2, 06/20/2017 <sup>1</sup>
GE-Hitachi Inspection Report RBS-08-122971	River Bend Station Unit 1, RF 14, Core Shroud Ultrasonic Examination	02/09/2008
Condition Report No. CR-RBS-2017-01510	Untitled – Condition Report summarizing inspections of core shroud welds H6B, V12, and V13 during refueling outage RF-19	12/15/2017
Condition Report No. CR-RBS-2017-01066	Untitled – Condition Report summarizing inspections of core shroud weld H4	02/07/2017

1. The staff performed its review of the referenced condition reports (CRs) as part of its review of the information and condition report summaries provided in the operating experience program effectiveness report (RBS-EP-15-00003, Revision 2). Dates and revision listed are those associated with Entergy Report No. RBS-EP-15-00003, Revision 2.

During the audit, the staff verified that the “scope of program” and “preventive actions,” program elements of the LRA aging management program are consistent with the corresponding elements of the GALL Report AMP. In addition, the staff found that, for the “parameters monitored or inspected,” “detection of aging effects,” “monitoring and trending,” and “acceptance criteria” program elements, there was insufficient information to determine whether these program elements were consistent with the corresponding program elements of the GALL Report AMP. In order to verify whether these program element are consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing RAIs for the subjects discussed below.



- Aging Management Review Item 3.1.1-43. The staff observed that the scope of the BWR Vessel Internals Program does not include management of loss-of-material effects that are induced by either a pitting or crevice corrosion mechanism. Instead, for aging management review items in LRA Table 3.1.2-2 for reactor vessel internals components aligned to Table 1 Aging Management Review Item 3.1.1-43, the applicant cites only license renewal application AMP B.1.43, “Water Chemistry Control – BWR,” to manage the relevant aging effect and mechanisms. In contrast, Aging Management Review Item 43 in SRP-LR Table 3.1-1 cites that GALL AMPs XI.M1, “ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD,” and XI.M2, “Water Chemistry,” are acceptable for managing loss of material due to pitting or crevice corrosion in these components. The staff observed that, by safety evaluation dated May 30, 2014, the applicant was granted a 10 CFR 50.55a(z) code relief which permitted the applicant to use the BWRVIP inspections of the BWR Vessel Internals Program as an alternative for meeting the ASME Section XI ISI requirements for reactor vessel internals components during the 4<sup>th</sup>, 10-year ISI interval for the plant. The staff may seek additional clarifications or justifications for why it is acceptable to use only license renewal application AMP B.1.43, “Water Chemistry Control – BWR,” as the basis for aging management in these aging management review line items, and why the applicant’s BWR Vessel Internals Program (license renewal application AMP B.1.10) has not been credited for aging management in addition to license renewal application AMP B.1.43, “Water Chemistry Control–BWR.”
- Aging Management Review Item 3.1.1-103: The staff observed, in LRA Table 3.1.1, Item 3.1.1-103, that the applicant did not credit the BWR Vessel Internals Program for managing cracking in the incore instrumentation (ICI) dry tubes, even though the applicant has been implementing replacements of the dry tubes in accordance with GE Services Information Letter 409, Revision 3. The staff may seek clarification on the basis for using the Inservice Inspection Program to manage cracking.
- “Preventive Actions”: The license renewal application AMP B.1.10 includes an enhancement to the “preventive actions” program element in regard to precluding the occurrence of intergranular stress corrosion cracking in reactor vessel internal components made from X-750 nickel alloy materials. The enhancement states that the applicant will revise the AMP procedures to state that, for core shroud repairs and other inter-granular stress corrosion cracking (IGSCC) repairs, the program will maintain operating tensile stresses below a threshold limit that precludes IGSCC of X-750 material.
  - (1) The staff observed that the applicant did not specify the threshold that would be applied to the tensile stress evaluation for the X-750 materials or provide specific details regarding the type of programmatic actions or activities that would be used to reduce or minimize the tensile stresses applied to the reactor vessel internals components that are made for X-750 materials. Without this information, the staff is unable to determine whether the specific actions or activities will be capable of reducing the tensile stress below an acceptable staff-endorsed threshold value on tensile stress values for the X-750 materials or whether the X-750 nickel alloy materials used to fabricate the components will be susceptible to cracking that is induced by an intergranular stress corrosion cracking mechanism.
  - (2) The staff observed that the applicant does not discuss how implementation of the referenced enhancement would impact the programmatic activities that will be

implemented under the BWR Vessel Internals Program or the methodologies in the applicable BWRVIP technical reports that will be applied to reactor vessel internals components in the RBS design. The staff also observed that the jet pump hold-down beams at RBS are the only reactor vessel internals components made from X-750 material and that the BWR Vessel Internals Program will perform inspections of these components in accordance with the staff-approved inspection and evaluation guidelines in BWRVIP-41. The staff did not have sufficient information to determine: (a) what the objective of the stated enhancement is in relation to implementing inspection and evaluation activities of the AMP, or (b) whether the stated enhancement (when implemented) would be creating any exceptions to GALL AMP XI.M9 that have yet to be identified in the AMP.

During the audit teleconference call of November 7, 2017, the applicant explained that the placement of the enhancement is intended only to update the procedure for the AMP in order to ensure that the “preventive actions” program element in the AMP will be consistent with that defined in GALL AMP XI.M9, “BWR Vessel Internals.” The applicant explained that, for those reactor vessel internals components made from X-750 type nickel-based alloys, the components will be inspected and evaluated in accordance with the BWRVIP’s applicable inspection and evaluation (I&E) methodologies issued by EPRI for the components. The staff found this explanation to be acceptable and determined that this meets the staff’s objectives for programmatic enhancements in Section 3.0 of the SRP-LR. The staff has closed this matter without the need for issuing an RAI on this topic.

- “Detection of Aging Effects”: The LRA aging management program includes an enhancement to the “detection of aging effects” program element stating that the applicant will evaluate the susceptibility to neutron or thermal embrittlement for reactor vessel internals components made from either CASS or X-750 nickel alloy materials. The staff observed that the stated enhancement does not provide any discussion on how the enhancement will be used in relation to managing the effects of aging for reactor vessel internals components made for CASS or X-750 materials or provide any details on whether implementation of this enhancement will be creating an exception to the program element criteria in the “detection of aging effects” program element or the “scope of program” element of the AMP.

During an audit teleconference call on November 7, 2017, the applicant explained that the placement of the enhancement is intended only to update the procedure for the AMP in order to ensure that the “preventive actions” program element in the AMP will be consistent with that defined in GALL AMP XI.M9, “BWR Vessel Internals.” The applicant explained that, for those reactor vessel internals components made from X-750 type nickel-based alloys, the components will be inspected and evaluated in accordance with the BWRVIP’s applicable inspection and evaluation (I&E) methodologies issued by EPRI for the components. The staff found this explanation acceptable and determined it meets the staff’s objectives for programmatic enhancements in Section 3.0 of the SRP-LR. The staff has closed this matter without issuing an RAI on it.

The information in LRA Appendix C, as supported by information in the program document for the BWR Vessel Internals Program, provides the applicant’s responses to the applicant action items (AAIs) that are applicable to BWRVIP technical reports that are within the scope of the AMP. The staff’s will evaluation the applicant’s responses to these applicant action items in the safety evaluation report; however, in order to determine whether the applicant’s LRA aging

management program can be adequate to manage the associated aging effects, the staff will consider issuing RAIs for the subjects discussed below.

- In its response to Applicant Action Item 4 on TR BWRVIP-26-A, the applicant stated that it will use Technical Report No. BWRVIP-183 as part of the bases for implementing the inspections of the top guide assembly during the period of extended operation. The staff issued its final safety evaluation report (FSER) for BWRVIP-183 on December 31, 2015. In the final safety evaluation report, the staff established three conditions or limitations on the use of methodology in BWRVIP-183. The staff noted that the applicant did not address in the LRA how the conditions or limitations in the final safety evaluation report for BWRVIP-183 are being accounted for as part of the inspection and evaluation protocols that will be applied to the top guide assembly components using the methods in BWRVIP-183.

During the audit teleconference call of November 7, 2017, the applicant explained that the implementation of BWRVIP-183 will be performed in accordance with the methodology approved in the staff's safety evaluation for the inspection and evaluation report, which was issued on December 31, 2015 (ML15246A312). The applicant also explained that the programmatic procedure that will be used to implement the methods in BWRVIP-183 will address those limitations placed in the staff's SE on the referenced inspection and evaluation methodology. The staff found this explanation to be acceptable because it meets the staff's expectations for implementing BWRVIP augmented inspection programs in accordance with the industry guideline in Nuclear Energy Institute (NEI) Report No. NEI-03-08 and the basis for implementing the BWRVIP-183 defined top guide inspections, as defined in the "scope of program" element in GALL AMP XI.M9, "BWR Vessel Internals." The staff has closed this matter without issuing an RAI.

- In its response to Applicant Action Item 4 on BWRVIP-27-A, the applicant stated that the standby liquid control (SLC)/core  $\Delta P$  lines inside the reactor vessel have no safety or license renewal intended function and are not subject to aging management review. Section 9.3.5.2 of the updated safety analysis report states the standby liquid control system (SLCS) is designed to meet the Anticipated Transient Without Scram (ATWS) requirements in 10 CFR 50.62, "Requirements for Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants," and to shut down the reactor and keep the reactor from going critical again as it cools. The updated safety analysis report also states that the internal portions of the standby liquid control lines are designed so the borated liquid "is piped into the reactor vessel and discharged near the bottom of the core, so it mixes with the cooling water rising through the core." Therefore, based on this updated safety analysis report information, the staff noted that the applicant may need to provide additional information in order to establish whether the internal portions of the standby liquid control system are within the scope of the LRA and subject to an aging management review, and whether supplemental inspection of the internals portions of the standby liquid control lines will need to be proposed for the period of extended operation.
- The "scope of program" element and program evaluation report for the AMP identify that the applicant is using the inspection and evaluation guidelines in BWRVIP-139-A as the basis for inspecting components in the plant's steam dryer assembly. The staff issued its basis for using the guidelines in BWRVIP-139-A, and Appendix B of the report. As outlined in a staff-issued safety evaluation dated November 8, 2016 (ML16180A462)

these guidelines were used to manage aging in BWR steam dryer assembly components. The staff's safety evaluation includes specific applicant action items that need to be addressed in order to justify use of BWRVIP-139-A for aging management of the steam dryer assemblies during the period of extended operation. The staff observed that the applicant did not provide any responses to the BWRVIP-139-A methodology applicant action items in the LRA. Therefore, the applicant may need to amend the LRA may to include these responses. The staff will consider issuing an RAI in regard to this matter.

During the audit of the "operating experience" program element, the staff's conducted an independent search. Through that search, the staff identified operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER. In light of the plant-specific operating experience, and in order to determine whether the applicant's LRA aging management program can be adequate to manage the associated aging effects, the staff will consider issuing RAIs for the subjects discussed below.

- The program document for the BWR Vessel Internals Program indicates that the BWRVIP-defined portion of the AMP does not include BWRVIP-defined inspections for incore instrumentation housings, guide tubes, and dry tubes in the plant design. However, the AMP's program evaluation report states that the guidance in General Electric Company (GE) Services Information Letter 409, Revision 3, includes augmented inspection and replacement guidance for incore dry tubes and indicates that the applicant has been performing inspections or replacements of the incore dry tubes per the guidelines in the GE services information letter. The staff observed, however, that the scope of the BWR Vessel Internals Program did not specify whether the guidelines in GE Services Information Letter 409, Revision 3, are within the scope of the AMP. The applicant's operating experience discussion indicates that the applicant will have replaced all pre-1986 dry tubes in the facility (including those with recordable indications or detected cracks) with the exception of 10 dry tubes scheduled for replacement during the 2017 refueling outage (RF-19) and another 6 dry tubes scheduled for replacement during the 2019 refueling outage. The applicant will replace these dry tubes under its implementation of the GE services information letter program. The staff noted that the AMP does not identify the applicant's replacement plans for these tubes as an enhancement of the program.
- The staff observed that the program document for the BWR Vessel Internals Program indicates that the configurations of the low-pressure coolant injection (LPCI) coupling 6-1a full penetration welds have not been able to meet the angle requirements needed to perform the EVT-1 visual examinations of welds using the guidelines in BWRVIP-42. The program document states that the welds will be examined using best effort exams until there is available tooling for examinations that can be credited for the weld locations. Further, the document states that until an inspection technique becomes available, the 6-1a welds shall be evaluated using BWRVIP-42, Rev. 1, Sections 3.9 and 3.10 for scope expansion if cracking is observed in similar welds (e.g., the 6-1b, 6-1c, and 6-1d low-pressure coolant injection coupling welds). The staff had insufficient information to determine whether any inspections of the low-pressure coolant injection coupling 6-1a weld had been performed at the site in accordance with the applicable methods and schedule for inspecting the weld in BWRVIP-42, Revision 1.

During the audit teleconference call of November 7, 2017, the applicant explained the difficulty in inspecting the low-pressure coolant injection coupling 6-1a weld. The applicant was not able inspect all of the weld during the initial refueling outage during which the weld was scheduled for inspection. The applicant clarified it performed a full inspection of the accessible portions of in low-pressure coolant injection coupling 6-1a weld according to the BWRVIP-42, Revision 1, protocols during the subsequent refueling outage (RF-18) for the facility and that the inspection did not indicate any flaw indications in the weld. The staff found this explanation acceptable because it meets the staff's expectations for implementing inspection of the low-pressure coolant injection coupling welds in accordance with the latest staff-approved BWRVIP inspection and evaluation methodology (as defined in BWRVIP-42, Revision 1). The staff has closed this matter without issuing an RAI.

- In some of the condition reports associated with the applicant's BWRVIP-defined inspections of the core shroud, the applicant reported cracking greater than anticipated in the core shroud's H4 horizontal weld and the occurrence of less extensive cracking in some of the other horizontal welds or axial welds in the shroud. The staff observed that the relevant condition report indicates an extent of cracking that totals about 19 percent of the total weld length for the H4 weld. The staff will consider issuing an RAI in regard to the following three issues: (1) the reinspection frequency applied to the core shroud, (2) the critical flaw size applied in assessment of the H4 shroud weld, and (3) the safety margin defining the acceptable unflawed ligament that remains in the H4 weld.
- The applicant's "operating experience" discussion cites numerous examples of cracking detected in the steam dryer support ring during the years 2000, 2006, and 2008. The staff had insufficient information to determine whether the applicant's operating experience was referencing a single flaw in the support ring, where the applicant had reinspected the component during the 2006 and 2008 outages. These were reinspected in order to determine potential increases in the extent of condition finding for the existing flaw, or to determine whether the applicant had detected numerous and separate flaws in the steam dryer support ring during those outages.

Following the staff's operating experience audit of the AMP in October 2017, and the audit breakout teleconference on November 7, 2018, the staff determined that the applicant has been performing sufficient flaw indication followup inspections of the steam dryer support skirt in accordance with the protocols in BWRVIP-139-A. As part of its review, the staff observed that the applicant has taken proper actions to demonstrate that the existing flaws in the support skirt are small, shallow, and pose no threat to the structural integrity of the steam dryer support skirt. The staff has closed this matter without issuing an RAI.

The staff also audited the updated safety analysis report supplement's description of the license renewal application AMP. The staff found insufficient to determine whether the updated safety analysis report supplement description was an adequate description of the LRA aging management program. In order to verify the sufficiency of the updated safety analysis report supplement program description, the staff will consider issuing RAIs for the subjects discussed below.

The topics of the potential RAIs that apply to the scheduled replacement activities for the incore instrumentation dry tubes and to the scoping questions on the internal portions of standby liquid control /core P lines also apply to the updated safety analysis report supplement summary description for the AMP, as defined in Section A.1.10 of the LRA.

**License Renewal Application AMP B.1.11, “Coating Integrity”**

Summary of Information in the Application. The license renewal application states that AMP B.1.11, “Coating Integrity,” is a new program that will be consistent with the program elements in GALL Report AMP XI.M42, “Internal Coatings/Linings for In-scope Piping, Piping Components, Heat Exchangers, and Tanks,” as described in LR-ISG-2013-01, “Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers and Tanks.” To verify this claim of consistency, the staff audited the LRA aging management program. At the time of the audit, the applicant had not yet fully developed the documents necessary to implement this new program, and the staff’s audit addressed only the program elements described in the applicant’s basis documents and operating experience. Issues that the NRC staff identifies but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents or the staff identified them while searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
RBS-EP-15-00007	Aging Management Program Evaluation Results Non-Class 1 Mechanical – Coating Integrity	Revision 0
RBS-EP-15-00002	Operating Experience Review Results – Aging Effects Requiring Management (AERM)	Revision 1
RBS-EP-15-00003	Operating Experience Review Results – Aging Management Program Effectiveness Coating Integrity Program	Revision 1
RBS-ME-15-00032	License Renewal Topical Report on Coating Integrity	Revision 0
CR-RBS-2009-0722	During an inspection of the control building chiller condenser service water side, several loose pieces of what appears to be epoxy coating were detected.	02/10/2009

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 aging management program are consistent with the corresponding elements of the GALL Report AMP.

In addition, the staff found that for the “scope of program” program element there was insufficient information to determine whether the scope of program element was consistent with the corresponding program element of the GALL Report AMP. In order to verify whether 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 “scope of program” program element of the LRA aging management program states that the environments associated with the Coating Integrity program are treated water, waste water, or lubricating oil. The GALL Report AMP recommends all component and environment combinations be identified. It is not clear to the staff that these statements are consistent because LRA Table 3.3.2-3, “Service Water System,” states that loss-of-coating integrity and loss of material will be managed by the Coating Integrity Program for a strainer exposed to raw water.
- During the audit, the staff reviewed RBS-ME-15-00032, which documents the basis for excluding six in-scope components from the scope of the coating integrity program based on loss-of-coating integrity not being an aging effect that requires management. For three out of the six components, the staff lacks sufficient information to complete its review as follows:
  - For lined piping located in the F tunnel: the piping is isolated on one end by a blind flange and on the other end there is a normally closed air-operated valve (AOV) upstream of the condensate storage tank (CST). As stated in the report, the line is pressurized to 200 psig. As a result, if the air-operated valve were to open, potential coating debris could be admitted to the condensate storage tank through a flow restriction orifice. Although the orifice would potentially block large coating debris, it is not clear whether smaller coating debris could impact the intended function of components downstream of the condensate storage tank. In addition, the report states that there is, “no safety-related equipment of piping near [the] line.” The term “near” lacks sufficient specificity. A leak from the pipe as a result of through-wall corrosion subsequent to loss-of-coating integrity could impact safety-related components that are not “near” the piping as a result of spray effects or flooding.
  - For the recovery sample tank system discharge to condensate storage tank header drain valve: the report states that there is no safety-related equipment or piping located near the valve. As described above, the term “near” lacks sufficient specificity.
  - For the precoat tank level transmitter root valve: the report states that there is no safety-related equipment or piping located near the valve. As described above, the term “near” lacks sufficient specificity.

During the audit of the “operating experience” program element, the staff’s independent database search identified operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER. In light of the plant-specific operating experience, in order to determine whether the applicant’s LRA aging management program can be adequate to manage the associated aging effects, the staff will consider issuing an RAI for the subject discussed below.

- The staff noted that during an inspection of the control building chiller condenser service water side, several loose pieces of what appears to be epoxy coating were detected (documented in CR-RBS-2009-0722). The condition report states: (a) the pieces of epoxy are small and will not prevent cooling water flow through the heat exchanger; (b) operation of the chiller before the inspection was within the expected bands for the monitored parameters; and (c) an apparent cause was not required for the condition adverse to quality. Based on the staff’s review of the corrective action entries for this condition report, it is not clear that the applicant ever identified the source of the epoxy debris. As a result, it not clear to the staff: (a) whether the debris is associated with a

coating material or some other foreign material; and (b) if the debris is a coating material, whether the Coating Integrity program can adequately manage loss-of-coating integrity for this coating.

The staff also audited the updated safety analysis report supplement’s description of the license renewal application AMP. The staff verified that the updated safety analysis report supplement description is consistent with the SRP-LR description as described in LR-ISG-2013-01.

**License Renewal Application AMP B.1.12, “Compressed Air Monitoring”**

Summary of Information in the Application. The LRA states that AMP B.1.12, “Compressed Air Monitoring,” is an existing program with enhancements and an exception that will be consistent with the program elements in GALL Report AMP XI.M24, “Compressed Air Monitoring.” To verify this claim of consistency, the staff audited the LRA aging management program. During the audit, the staff reviewed the exception and enhancements associated with this AMP. The staff will evaluate the exception to the GALL Report AMP and the enhancements in the SER.

Audit Activities. During its audit, the NRC 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 following keywords: instrument air, air, and leak.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents or the staff identified them while searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
RBS-EP-15-00007	Aging Management Program Evaluation Results Non-Class 1 Mechanical	Revision 0
EN-LI-121	Trending and Performance Review Process	Revision 20
TSP-0028	Periodic Sampling Of Plant Compressed Air Systems	Revision 306
COP-0043	Sampling Instrument Air System For Particulate and Oil Analysis	Revision 004

During the audit, the staff verified that the “scope of program,” “preventive actions,” “parameters monitored or inspected,” “detection of aging effects,” and “acceptance criteria” program elements of the LRA aging management program are consistent with the corresponding element of the GALL Report AMP. The staff also verified that aspects of the “monitoring and trending” program element not associated with an exception identified in the LRA or by the staff during the audit are consistent with the corresponding program elements in the GALL Report AMP.

During the audit of the “operating experience” program element, the staff’s independent database search did not identify any operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER.



The staff also audited the updated safety analysis report supplement's description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP.

**License Renewal Application AMP B.1.13, “Containment Inservice Inspection—IWE”**

Summary of Information in the Application. The LRA states that AMP B.1.13, “Containment Inservice Inspection—IWE,” is an existing program with enhancement that will be 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 license renewal application AMP. During the audit, the staff reviewed the enhancement associated with this AMP. The staff will evaluate the enhancement in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant's staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. RBS-EP-15-00008	Aging Management Program Evaluation Report (AMPER) Civil/Structural: Section 3.2 Containment Inservice Inspection – IWE	Revision 1
2. SEP-CISI-RBS-001	Program Section for ASME Section XI, Division 1, RBS Containment Inservice Inspection (CISI) Program	Revision 0
3. CEP-CII-003	Visual Examinations of Class MC Components	Revision 305
4. CEP-NDE-0903	VT-3 Examination (ASME Section XI)	Revision 5
5.EN-MA-145	Nuclear Management Manual: Maintenance Standard for Torque Applications	Revision 8
6. EN-DC-141	Nuclear Management Manual: Design Inputs	Revision 15
7. CR-RBS-92-0198	NRC IN 92-20 Local Leak Rate Testing – Evaluation to Ensure RBS Performs Adequate LLRTs	04/06/1992
8. RBS-EP-15-00003	Operating Experience Review Results – Aging Management Program Effectiveness, Section 3.1.10 Containment Inservice Inspection (CII) IWE Program	Revision 2
9. RBS-EP-15-00002	Operating Experience Review Results – Aging Effects Requiring Management (AERM)	Revision 1
10. RBS-EP-15-00010	Aging Management Review Summary	Revision 1
11. RBS-CS-15-00001	Aging Management Review of Reactor Building	Revision 1
12. CR-RBS-2008-00941	Indication (Pit) on Suppression Pool Floor during IWE Examination	1/28/2008

Document	Title	Revision / Date
13. CR-RBS-2011-06041	Evaluation of NRC IN 2011-15, Steel Containment Degradation and Associated License Renewal Management Issues	08/11/2011
14. CR-RBS-2010-03033	Evaluation of NRC IN 2010-12 Containment Liner Corrosion	07/06/2010
15. CR-RBS- 2013-03489	EL 113' Primary Containment Airlock to Fuel Building – inside of door adjustable bolt bent, door operable – replaced bolt	05/03/2013
16. CR-RBS- 2012-03747	Containment Equipment Hatch Bolt in Hole #35 and Threaded Insert Damaged (Galled)	06/04/2012
17. CR-RBS- 2009-05468	EL 171' Containment Airlock mechanical interlock mechanism upper stop bolt on outer door broken and nonfunctional	10/15/2009
18. CR-RBS-2015-03748	Possible Discrepancy in CISI Program from extended containment areas created when the IFTS blind flange is removed that are currently not inspected	05/21/2015

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 license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP, as applicable to RBS.

During the audit, the staff observed:

- The staff noted that the program description in LRA Section B.1.13 “Containment Inservice Inspection—IWE” program did not include a typical in-scope component “moisture barriers.” The staff reviewed Sections 2.5.1 and 3.6.3.2 of procedure SEP-CISI-RBS-001 for the RBS Containment Inservice Inspection Program and confirmed that the RBS containment design does not include moisture barriers. This supports the consistency conclusion above for the “scope of program” element.

During the audit of the “operating experience” program element, the staff’s independent database search did not identify any operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff’s will address its review of the identified plant-specific operating experience in the SER.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

### **License Renewal Application AMP B.1.14, “Containment Leak Rate”**

Summary of Information in the Application. The license renewal application states that AMP B.1.14, “Containment Leak Rate,” is an existing program that is consistent with exceptions 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 license renewal application AMP. Issues that the NRC staff identifies but does not resolve in this report, the staff will address in the SER. During

the audit, the staff reviewed the exceptions associated with this AMP. The staff will evaluate exceptions to the GALL Report AMP in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant's staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
RBS-EP-15-00008	B.1.14 Containment Leak Rate Program. RBS License Renewal Project Aging Management Program Evaluation Report (AMPER) Civil/Structural	Revision 1
RBS-EP-15-00003	Section 3.1.11, "Containment Leak Rate Program." RBS License Renewal Project. Operating Experience Review Results – AMP Effectiveness	Revision 1
SEP-APJ-004	River Bend Station: Primary Containment Leakage Rate Testing (Appendix J) Program	Revision 5
CEP-NDE-0903	CEP-NDE-0903, VT-3 Visual Examination (ASME XI)	Revision 5
EN-DC-334	Primary Containment Leakage Rate Testing (Appendix J), Entergy Nuclear Management Manual	Revision 3
SEP-CISI-RBS-001	ASME Code, Section XI, Division 1, RBS Containment Inservice Inspection (CISI) Program	Revision 0
CEP-APJ-001	Primary Containment Leakage Rate Testing (10CFR50 Appendix J) Program Plan, Entergy Nuclear Engineering Programs	Revision 3
RBS USAR	Chapter 6, Engineered Safety Features	Revision 24
RBS TS 5.5.13	Primary Containment Leakage Rate Testing Program	Amendment No.191
LO-RL0-2014-0137 CA 1	Focused Area Self-Assessment	01/22/2015
ML15307A293	License Amendment Request for change to Technical Specification: 5.5.13, to extend Drywell Bypass Test Frequency to 15 Years and Type C Test Frequency to 75 Months, River Bend Station, Unit 1	10/29/2015
ML16215A194	Response to NRC Request for Additional Information - RBS License Amendment Request to Extend Type A and Type C Test Frequencies, River Bend Station, Unit 1	07/27/2016
ML16287A599	River Bent Station Unit 1 – Issuance of Amendment, Extension of Containment Leakage Tests Frequency	10/27/2016

During the audit, the staff verified that the “preventive actions,” “monitoring and trending,” “detection of aging effects,” and “acceptance criteria” program elements of the license renewal application AMP are consistent with the corresponding element of the GALL Report AMP.

The staff also verified that aspects of the “parameters monitored or inspected,” and “corrective actions,” program elements not associated with the exceptions identified in the LRA or by the

staff during the audit are consistent with the corresponding program elements in the GALL Report AMP.

In addition, the staff found that for the “scope of program,” program element, sufficient information was not available to determine whether it was consistent with the corresponding program elements of the GALL Report AMP. In order to verify whether this program element is consistent with the corresponding program element of the GALL Report AMP, the staff will consider issuing a RAI for the subject discussed below.

- The license renewal application states that AMP B.1.14, “Containment Leak Rate,” is consistent with the GALL Report (NUREG-1801, Revision 2) AMP XI.S4, “10 CFR Part 50, Appendix J.” The “scope of program” program element of Gall Report AMP XI.S4 recommends leak rate testing of “all containment boundary pressure-retaining components.” The staff reviewed SEP-APJ-004, Revision 5, “River Bend Station Primary Containment Leakage Rate Testing (Appendix J) Program,” the implementing procedure (see also RBS Updated Safety Analysis Report Table 6.2-40) for 10 CFR 50 Appendix J leakage rate testing, and noted that certain containment pressure retaining components are excluded from local leakage rate testing (LLRT). It is not clear how the applicant intends to manage the effects of aging for these components excluded from leak rate testing consistent with 10 CFR 54.21(a)(3) requirements.

During the audit, the staff observed:

- The staff reviewed procedure SEP-APJ-004, “River Bend Station: Primary Containment Leakage Rate Testing (Appendix J) Program,” Revision 5, and noted that this revised procedure lacked consistency with RBS Technical Specification (TS) Section 5.5.13 when identifying the implementing document for 10 CFR Part 50 Appendix J, “Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors”. The staff discussed this discrepancy with the applicant. The applicant subsequently corrected the inconsistency by revising RBS TS 5.5.13 to clearly identify that the implementing documents for 10 CFR Part 50 Appendix J. These are (1) NEI 94-01, “Industry Guideline for Implementing Performance-Based Option of 10 CFR 50, Appendix J,” Revision 3-A, dated July 2012, and (2) for the conditions and limitations, Section 4.1 of NEI 94-01, Revision 2-A, dated October 2008).

During the audit of the “operating experience” program element, the staff’s independent database search did not identify any operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff’s will evaluate the identified plant-specific operating experience in the SER.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR. However, similar to the observation made above for RBS procedure SEP-APJ-004, the updated safety analysis report supplement lacked consistency with the RBS technical specifications when identifying the implementing document for 10 CFR Part 50 Appendix J. The staff discussed this inconsistency with the applicant, and the applicant corrected it.

### **License Renewal Application AMP B.1.15, “Diesel Fuel Monitoring”**

Summary of Information in the Application. The license renewal application states that AMP B.1.15, “Diesel Fuel Monitoring,” is an existing program with enhancements that will be

consistent with the program elements in GALL Report AMP XI.M30, “Fuel Oil Chemistry.” To verify this claim of consistency, the staff audited the license renewal application AMP.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of the fuel oil storage tanks for the standby diesel generators and the diesel-driven fire pumps. The staff also conducted an independent search of the applicant’s operating experience database using the following keywords: biological, fuel oil, block, and tank.”

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
RBS-EP-15-00007	Aging Management Program Evaluation Results Non-Class 1 Mechanical	Revision 0
EN-CY-103	Diesel Fuel, Lubricating Oil and Grease Analytical Services	Revision 1
STP-309-0201	Division 1 Diesel Generator Operability Test	Revision 056
CSP-0131	Receipt, Storage, and Handling of Diesel Fuel Used in Standby Diesel Engines	Revision 304
CSP-0100	Chemistry- Required Surveillances and Actions	Revision 29
COP-0002	Sampling of Petroleum & Petroleum Products	Revision 12
EN-LI-121	Trending and Performance Review Process	Revision 20
PDC-1-EGF-090	Standby Diesel Generator (Tank A Drawing)	Revision 4
PDC-1-EGF-091	Standby Diesel Generator (Tank B Drawing)	Revision 7
PDC-1-EGF-092	Standby Diesel Generator (Tank C Drawing)	Revision 7

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 license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff’s independent database search did not identify any operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff found insufficient information to determine whether the updated safety analysis report supplement description was an adequate description of the license renewal application AMP. In order to verify the sufficiency of the updated safety analysis report supplement program description, the staff will consider issuing RAls for the subject discussed below.

The LRA Section A.1.15 does not include the industry standards (e.g., ASTM) used in the program, which is contrary to the SRP-LR recommendations.

**LRA AMP B.1.15, “Diesel Fuel Monitoring,” Onsite Audit**

Audit Activities. During its onsite audit, the staff conducted walkdowns of the fuel oil storage tanks for the standby diesel generators and the diesel-driven fire pumps. Since very limited portions of the standby diesel generator fuel oil storage tank drain lines were viewable, the staff requested that the associated piping isometric drawings be added to the portal. The staff made the following observations for the diesel-driven fire pump fuel oil tanks:

- the tanks sit on support structures about 4 feet above the floor;
- the tank drain lines are located directly below the tanks and consist of a straight vertical pipe, approximately 6-inches long, plus the drain valve.

**License Renewal Application AMP B.1.16, “Environmental Qualification (EQ) of Electric Components”**

Summary of Information in the Application

The LRA states that AMP B.1.16, “EQ of Electric Components,” manages the effects of thermal, radiation, and cyclic aging through the use of aging evaluation based on 10 CFR 50.49(f) qualification methods. As required by 10 CFR 50.49, before reaching the aging limits established in the evaluation, operating license holders must either refurbish or replace environmental qualification components or extend their qualifications. Some aging evaluations for environmental qualification components are time-limited aging analyses (TLAAs) for license renewal. The LRA also states that the environmental qualification of electric components is an existing program and 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 license renewal application AMP and operating experience. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC 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 following keywords: EQ components, adverse localized condition, temperature, radiation, cycle, and thermal cycling.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified the documents by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
EC-RBS-25340-EQ	Updating EQAR Document for 24 Month Cycle	Revision 0
RBS-EP-15-00009	RBS License Renewal Project Aging Management Program Evaluation Results – Electrical	Revision 1

Document	Title	Revision / Date
EC-RBS-27730-EQ xmitters	Review Impact of Revision I of Qualification Report 108025 On Rosemount Qualification	Revision 0
EC-RBS-42625-EQ	Evaluate the EQ Qualification Life for SCRAM Pilot Solenoid Valves	Revision 0
EC-RBS-48692-EQ	Evaluate Extending the EQ Preventive Maintenance for HVR-AOD Limit Switches and Evaluate Acceptability of GE Summary Report for Used of CR120B Relay at River Bend Station	Revision 0
EC-RBS-46490-EQ MOV	Determine If B21-MOV F065A & B Are Required To be Environmentally Qualified	Revision 0
EC-RBS-65450-EQ	Update Capacity Factor Calculation G13.18.9.0-008 For Input in to EQ Life	Revision 0

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

During the audit of the “operating experience” program element, the staff’s independent database search did not identify any operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

### **License Renewal Application AMP B.1.17, “External Surfaces Monitoring”**

Summary of Information in the Application. The license renewal application states that AMP B.1.17, “External Surfaces Monitoring,” is an existing program with enhancements that will be consistent with the program elements in GALL Report AMP XI.M36, “External Surfaces Monitoring of Mechanical Components,” as modified by LR-ISG-2012-02, “Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion under Insulation.” To verify this claim of consistency, the staff audited the license renewal application AMP. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER. The staff’s evaluation of the associated enhancements, which were reviewed during the audit, will be documented in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of portions of the standby service water system piping as it related to external surface corrosion. The staff also conducted an independent search of the applicant’s operating experience database using the following keywords:orros, leak, loss of material, piping, and rust.

The table below lists the documents that the staff reviewed and found to be relevant during the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
RBS-EP-15-00003	Operating Experience Review Results, Aging Management Program Effectiveness, Section 3.1.14, "External Surfaces Monitoring Program"	Rev 1
RBS-EP-15-00007	Aging Management Program Evaluation Results Non-Class 1 Mechanical, Section 4.5, "External Surfaces Monitoring"	Rev 0
EN-DC-178	System Walkdowns	Rev 7
CR-RBS-2014-01005	Maintenance Rule Structural inspections of the Category 1 Tunnels identified one side of a four sided weld at a based plate completely degraded as a result of the concentrated corrosion believed to be the result of excessive condensation in the tunnel.	02/27/2014
CR-RBS-2014-03098	Service Water Primary (SWP) 20 inch return header has pipe weld degradation, around entire diameter up to 1/4 inch deep. This degradation appears to be due to continuous rain water run-off from various components above the weld. The SWP piping is severely rusted, pitted and brittle in two areas of the weld, directly on top and bottom of the pipe.	06/26/2014
CR-RBS-2014-03643	General coating degradation on Standby Service Water piping and associated components in the plant area when the F-Tunnel and G-Tunnel connect. General surface coating degradation is present on the exterior of the Service Water Piping at this location.	07/24/2014
CR-RBS-2015-03429	Leak from SWC [Service Water Cooling]-006-059. The coating around the valve, pipe, and tube steel support has degraded and the underlying metal is corroded. This leak is also causing ponding at the base of pipe supports SWP-PSR8252A4 and SWP-PSR8232A4 which has caused corrosion of the tube steel connection to the embed plate in the slab.	05/08/2015
CR-RBS-2016-02355	NRC Resident Observations: 10) SWP Corrosion control. Located in various tunnels. Numerous signs of corrosion were observed. How is corrosion being managed in these areas? What is effect on SWP? Is everything in spec? What is monitoring corrosion of equipment" What is threshold for action	03/22/2016
CR-RBS-2017-00882	System engineering walkdown of Drywell Unit Coolers and instrument air system detected instrument air leaks by using a sonic leak detector at a number of regulators. Using the sonic gun, the leak rate cannot be quantified; however, the leak on SWP-TV98B and C registered much louder than the others.	02/02/2017

During the audit, the staff verified that the "scope of program," "preventive actions," "detection of aging effects," and "acceptance criteria" program elements of the license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP. However, the staff found that for the "parameters monitored or inspected" and "monitoring and trending" program elements, there was insufficient information to determine whether they were consistent with the corresponding program elements of the GALL Report AMP. In order to verify whether this program element is consistent with the corresponding program elements 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 states that system walkdowns monitor for leakage. Although this is consistent with the GALL Report AMP, the internal environment specified for some piping and components in several systems included gaseous environments. It is not clear to the staff how the program intends to detect cracking in components where indications of leakage (through the presence of droplets or puddles of liquids) would not be present due to a nonaqueous internal environment.



- For the “monitoring and trending” program element, during the onsite audit, the staff noted that the external surfaces of the service water piping in several of the underground connecting tunnels showed varying degrees of coating degradation with consequent surface corrosion. Based on this observation, it is not clear to the staff whether comparable observations have been made during existing periodic system walkdowns prescribed by EN-DC-178 and whether issue resolution was initiated in accordance with EN-DC-178, Attachment 9.3.
- During the onsite audit, the staff noted that the air intakes for the diesel generator building provide direct access of the outdoor air to most of the components within the building. Based on this, the staff questioned the basis for considering the ambient external environment within the building as air-indoor, as indicated in LRA Tables 3.3.2-10, “Standby Diesel Generator,” and 3.3.2-11, “HPCS Diesel Generator.”

During the audit of the “operating experience” program element, the staff’s independent search of the applicant’s operating experience database did not identify any operating experience to indicate that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER. The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR, as modified by LR-ISG-2012-02.

#### **License Renewal Application AMP B.1.17, “External Surfaces Monitoring,” Onsite Audit**

Audit Activities. During its audit, the staff conducted walkdowns of room air intakes for the diesel generator building and limited portions of the normal and standby service water piping in the underground tunnels. The staff made the following observations:

- for the air intake plenums, under normal operating conditions, outside air is drawn directly into the diesel generator rooms, without any conditioning of the ambient air;
- for the service water piping, some portions near the standby cooling tower basin wall had extensive surface corrosion as a result of peeling and completely missing paint.

## License Renewal Application AMP B.1.18, Fatigue Monitoring

Summary of Information in the Application. The LRA states that AMP B.1.18, “Fatigue Monitoring,” is an existing program with enhancements that will be 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. During the audit, the staff reviewed the enhancements associated with the AMP. The enhancements are evaluated in the SER.

Audit Activities. During its audit, the staff interviewed the applicant’s staff and reviewed onsite documentation provided by the applicant.

The table below lists the documents that were reviewed by the staff and were found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED**

Document	Title	Revision / Date
RBS-EP-15-00006	Aging Management Program Evaluation Report Class 1 Mechanical (Section 4.7, Fatigue Monitoring)	Revision 0
RBS-EP-15-00003	Operating Experience Review Results – Aging Management Program Effectiveness (Section 3.1.15, Fatigue Monitoring)	Revision 2
EDP-MP-05	Fatigue Management	Revision 301
RBS-EP-17-00006	Fatigue Update for River Bend Nuclear Station Using FatiguePro Software	Revision 0
6247.547-604-001A	Fatigue Update for River Bend Nuclear Station Using FatiguePro Software	Revision 302
CR-RBS-2016-00656	Fatigue Data Retrieval Issue in Use of FatiguePro Software	1/22/2016

During the audit, the staff verified that the “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 “scope of program,” “parameters monitored or inspected,” and “corrective actions” program elements, sufficient information was not available to determine whether they were consistent with the corresponding program elements of the GALL Report AMP. In order to obtain the information necessary to verify whether 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 “parameters monitored or inspected” program element of the GALL Report AMP recommends that the program monitor and track all plant design transients that cause cyclic strains, which are significant contributors to the fatigue usage factor. The GALL Report AMP also recommends that the program monitors and tracks the number of critical thermal and pressure transients for the selected components. The applicant’s fatigue management procedure (EDP-MP-05) indicates that some adverse emergency or faulted transients may be counted as normal transients in the event the transients occur. The staff determines that the use of the word “some” may be sufficiently imprecise to merit gathering additional information to confirm whether the program adequately identifies and counts critical transients that involve emergency or faulted conditions.

- In relation to the “parameters monitored or inspected” program element, LRA Section 4.6 addresses fatigue analyses for the containment liner plate, metal containments, penetrations and other structural components (e.g., the polar crane and equipment hatch). LRA Section 4.6 also indicates that the Fatigue Monitoring Program is used to manage the aging effects due to fatigue for these containment components. In contrast, the applicant’s fatigue management procedure (EDP-MP-05) and updated fatigue analysis results (RBS-EP-17-00006) do not clearly describe fatigue monitoring and management activities for these structural components.
- The applicant’s enhancement to the “preventive actions” program element states that an environmentally assisted fatigue analysis using NUREG CR-6909 will not use average temperature for complex transients. NUREG CR-6909 Report provides equations that can be used to calculate environmental fatigue correction factors and indicates that service temperature is used in the calculations. Given the applicant’s statements concerning temperatures used in its fatigue analysis, it is not clear to the staff whether the applicant’s analyses follow the guidance contained in NUREG CR-6909.
- The “corrective actions” program element of the GALL Report AMP states that acceptable corrective actions include repair of the component, replacement of the component, and a more rigorous analysis of the component to demonstrate that the design code limit for fatigue will not be exceeded during the period of extended operation. The “corrective actions” program element of the applicant’s program described in the program basis document (RBS-EP-15-00006) does not address specific corrective actions. The lack of these corrective actions appears inconsistent with the GALL Report AMP.

During the audit of the “operating experience” program element, the staff’s independent database search identified operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff’s evaluation of the identified plant-specific operating experience will be addressed in the SER. In light of the plant-specific operating experience, in order to obtain the information necessary to determine whether the applicant’s LRA AMP can be adequate to manage the associated aging effects, the staff will consider issuing an RAI for the subject discussed below regarding the adequacy of fatigue data collection and monitoring activities.

- Condition Report CR-RBS-2016-00656 indicates the following information related to the effectiveness of fatigue cycle monitoring: The FatiguePro software uses the COLLECT program to retrieve cycle and fatigue related data from the ERIS computer. During the retrieval of Cycle 18 data, it was noticed that the COLLECT program unexpectedly stopped automatically recording data from November 2012 to September 2013. The Collect computer has been restored to service. Data on the Collect computer was not recoverable.

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

**License Renewal Application AMP B.1.19, “Fire Protection”**

Summary of Information in the Application. The license renewal application states that AMP B.1.19 “Fire Protection” is an existing program 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 license renewal application AMP.

Audit Activities. During its audit, the NRC 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 following keywords: Halon 1301, fire suppression agent, fire barriers, fire wraps, fire damming material, fire penetration seals, shrinkage, and fire doors.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision/Date</b>
STP-000-3601	Inaccessible Fire Barrier Outage Inspection	Revision 4
STP-000-3602	Fire Barrier Visual Inspection	Revision 15
WO 52633995	Work Order completed under STEP-000-3601 and -3602	10/11/2016
STP-000-3604	Fire Barrier Sealed Penetration Inspection	Revision 302
WO 52633110	Work Order completed under STEP-000-3604	10/11/2016
STP-000-3608	Fire Door Visual Inspection	Revision 301
WO 52611521	Work Order completed under STEP-000-3608	07/13/2016
STP-250-4513	FPM-PNL1 Fire Detection Functional Test for PGCC Zone SD137 and Operability Test for PGCC Halon System U747	05/24/2016
CR-RBS-2010-01140	Potential adverse trend in the material condition of plant fire doors	03/11/2010
CR-RBS-2011-01137	Halon bottle connected to FRG-SOV2B located next to HIS-PNL01 on Normal Switchgear 123’ has an out-of-service tag dated 08/30/2007.	01/25/2011
CR-RBS-2016-00608	Some fire sealant/caulk applied to seams in the fire board and around the penetration while others were not.	01/21/2016

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 license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff’s independent database search identified no operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

**License Renewal Application AMP B.1.20, “Fire Water System”**

Summary of Information in the Application. The LRA states that AMP B.1.20, “Fire Water System,” is an existing program with enhancements and exceptions that will be consistent with: the program elements in GALL Report AMP XI.M27, “Fire Water System,” as modified by LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion under Insulation." The staff noted that the Fire Water System

Program also establishes requirements for managing loss-of-coating integrity, as recommended in AMP XI.M42, “Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks,” as issued by LR-ISG-2013-01, “Aging Management of Loss of Coating or Lining Integrity for Internal Coatings/Linings on In-Scope Piping, Piping Components, Heat Exchangers, and Tanks.” To verify this claim of consistency, the staff audited the license renewal application AMP. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER. During the audit, the staff reviewed the exceptions and enhancements associated with this AMP. The staff will evaluate the exceptions to the GALL Report AMP and the enhancements in the SER.

**Audit Activities.** During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
RBS-EP-15-00007	Aging Management Program Evaluation Results Non-Class 1 Mechanical Fire Water System	Revision 0
RBS-EP-15-002	Operating Experience Review Results – Aging Effects Requiring Management (AERM)	Revision 1
RBS-EP-15-00003	Operating Experience Review Results – Aging Management Program Effectiveness	Revision 1
R-STM-0250	Fire Protection and Detection	Revision 7
52703912	Work Order FPP-101 (CS): Fire Suppression System Inspection – Cold Shutdown Portion Conducted	02/08/2017
52748470	Work Order FPP-101 (CS): Fire Suppression System Inspection – Cold Shutdown Portion Conducted	08/20/2017
52762725	Work Order FPP-0101 Perform Monthly Fire Suppression System Inspection	08/08/2017
52768578	Work Order FPP-0101 Perform Monthly Fire Suppression System Inspection	08/14/2017
52673158	Work Order FPP-0109 Fire Protection Sprinkler System Functional Test Outside the Protected Area	03/30/2016
52481488	Work Order FPP-0109 Fire Protection Sprinkler System Functional Test Outside the Protected Area	10/01/2014
52423280	Work Order FPP-0113 Fire Hose Station Water Flow Test and Hose Hydro Inspection	04/28/2014
CR-RBS-2016-7680	FPW-TK1A, Fire Suppression Water Storage Tank Internal Coating Blistering	11/10/2016
CR-RBS-2016-7939	FPW-TK1B, Fire Suppression Water Storage Tank Internal Coating Blistering	11/22/2016

Document	Title	Revision / Date
00250692	Work Order FPW-TK1A Internal Tank Inspection	05/18/2011
00242146	Work Order FPW-TK1B Internal Tank Inspection	07/13/2011
52689345	Work Order STP-251-3401 Fire Hydrant Six Month Inspection	10/11/2016
52611522	Work Order STP-251-3501 Tech Spec Related Yard Fire Hydrant Flow Test	02/06/2016
52660042	Work Order STP-251-3601 Fire Protection Sprinkler Header/Nozzle Inspection	04/26/2017
52533245	Work Order STP-251-3602 Fire Protection Pump Functional Test	06/10/2015
52633994	Work Order STP-251-3602 Fire Protection Pump Functional Test	12/07/2016
52241530	Work Order STP-251-3700 Fire System Yard Water Suppression Loop Flow Test	11/08/2012
52528148	Work Order STP-251-3700 Fire System Yard Water Suppression Loop Flow Test	11/07/2015
52221777	Work Order STP-251-3701 Spray and Sprinkler Open Nozzle Head Air Flow Test	08/08/2012
52505675	Work Order STP-251-3701 Spray and Sprinkler Open Nozzle Head Air Flow Test	07/16/2015
EB-006A	Fire Pump House Piping and BLDG Service	Revision 11
12210-EC-55A-2	Plans and Details Yard Tankage Foundations	Revision 2
237.400	Specification for Field Fabricated Tanks	12/04/1974
SOP-0037	Fire Protection Water System Operating Procedure (System#251)	12/21/2016
RBS-ME-15-00030	License Renewal Topical Report on Recurring Internal Corrosion	Revision 1
CR-RBS-2016-2461	During conduct of FPP-0109, a hole was noted in the piping associated with AS-51	03/25/2016
CR-RBS-2008-3428	The fire protection drain header in the diesel generator building, 67-foot elevation north end is leaking water at a rate of approximately one gallon per minute.	05/21/2008

During the audit, the staff verified that the “preventive actions,” “parameters monitored or inspected,” and “monitoring and trending” program elements of the license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP XI.M27. The staff verified that the “preventive actions” program element is consistent with AMP XI.M42. The

staff will document the consistency of the “parameters monitored or inspected” and “monitoring and trending” program elements with GALL Report AMP XI.M42 in the SER.

The staff also verified that aspects of the “detection of aging effects,” and “corrective actions” program elements not associated with the exceptions identified in the LRA or by the staff during the audit are consistent with the corresponding program elements in the GALL Report AMPs (i.e., AMP XI.M27 and AMP XI.M42).

In addition, the staff found that for the “scope of program,” “detection of aging effects,” “acceptance criteria,” and “corrective actions” program elements, there was insufficient information to determine whether the program elements are consistent with the corresponding program elements of the GALL Report AMPs. In order to verify whether these program elements are consistent with the corresponding program elements of the GALL Report AMPs, the staff will consider issuing RAIs for the subjects discussed below.

- The “detection of aging effects” program element of the license renewal application AMP states an enhancement to the program to verify that fire hydrant barrels drain within 60 minutes after flushing or flow testing. GALL Report AMP XI.M27 recommends that National Fire Protection Association (NFPA) 25 Section 7.3.2, “Hydrants,” be met. It is not clear to the staff that these statements are consistent because NFPA Section 7.3.2 also states that each hydrant shall be opened fully and water flowed until foreign material has cleared and that flow is maintained for at least 1 minute.
- The “detection of aging effects” program element of the license renewal application AMP states enhancements to the program to conduct internal tank inspections including: (a) inspections in accordance with NFPA 25 Section 9.2.6, “Interior Inspection,” and NFPA 25 Section 9.2.7, “Tests During Interior Inspections;” and (b) ultrasonic thickness measurements of the fire water storage tanks (FWSTs) when there is evidence of pitting or corrosion. GALL Report AMP XI.M27 states that regardless of conditions observed on the internal surfaces of the tank, bottom thickness measurements should be taken on each tank during the first 10-years of the period of extended operation. It does not appear that these statements are consistent because wall thickness inspection requirements (which include bottom thickness measurements) will only occur if there is evidence of corrosion.
- LRA Table 3.3.2-7 states that loss-of coating integrity is managed by the Fire Water System Program for internally coated piping and piping components. The license renewal application AMP does not include the recommendations for managing loss-of -coating integrity associated with fire water system piping and piping components. GALL Report AMP XI.M42, as issued by LR-ISG-2013-01, states that an applicant may elect to manage the aging effects for internal coatings/linings for in-scope piping, piping components, heat exchangers, and tanks in an alternative AMP that is specific to the component or system in which the coatings/linings are installed as long as the recommendations of GALL Report AMP XI.M42 are incorporated into the alternative program and exceptions or enhancements associated with the recommendations in GALL Report AMP XI.M42 are included in the alternative AMP. It is not clear to the staff that these statements are consistent because although the applicant will use the Fire Water System Program to manage aging effects associated with internally coated piping and piping components, the program only addresses requirements for the internally coated fire water storage tanks.
- The license renewal application AMP states an enhancement to the “detection of aging effects” program element. The enhancement lists several deluge sprinkler systems for which the inspection procedures will be revised to conduct an internal visual inspection.

During the audit, the staff confirmed that all of the deluge sprinkler systems listed in Enhancement No. 2 are addressed in the plant-specific nozzle inspection procedure. However, this procedure also includes several other deluge sprinkler systems that are not included in the enhancement (for example, systems protecting components in the turbine, auxiliary control, and fire protection buildings). LRA Section 2.4.3 states that these buildings provide physical support, shelter, and protection for structures, systems, and components that have intended functions consistent with 10 CFR 54.4, "Scope." The staff lacks sufficient information to conclude that the deluge sprinkler systems listed in Enhancement No. 2 include all those necessary to protect components with intended functions within the scope of 10 CFR 54.4.

- The license renewal application AMP states an enhancement to the "detection of aging effects" program element. The enhancement lists several pressure-reducing valves for which the inspection procedures will be revised to inspect, test, and maintain the valves in accordance with NFPA 25 Section 6.3.1.4. The staff lacks sufficient information to confirm that these are the only pressure-reducing valves that protect in-scope components.
- The license renewal application AMP states an exception to the "detection of aging effects" program element. The exception states that flow testing in accordance with NFPA 25, Section 6.3.1, "Flow Tests," will not be conducted. The basis for the exception is that fire hoses are tested every 3 years and main drain tests are conducted on 20 percent of the standpipes and risers every refueling outage. During the audit, the staff reviewed the fire hose test procedure. The acceptance criteria for the test is that after flowing 2-to-3 gallons into a container with the valve partially open, the test personnel verifies that the "flow is free of any blockage." This testing is insufficient to establish a basis for the exception because: (a) the valve is only partially opened and as a result, insufficient flow velocity could be established to result in fouling products to transfer to the bucket; and (b) the results cannot be trended because there is no quantification of the fouling products. The results of flow tests conducted in accordance with NFPA 25, Section 6.3.1, can be trended and therefore provide advance warning of potential fouling issues. The main drain tests are insufficient as a basis for the exception because main drain tests are recommended to be conducted in addition to the flow testing.
- The license renewal application AMP states an enhancement to the "acceptance criteria" program element. The enhancement states that coatings will meet the plant-specific design requirements for the coating/lining and substrate for the fire water storage tanks. It is not clear to the staff that the acceptance criterion in Enhancement No. 19 is applicable to adhesion testing. It is possible that the acceptance criterion could be interpreted to only apply to coating characteristics such as material type, dry film thickness, etc.

During the audit, the staff observed:

- The staff reviewed Specification 237.400 and noted that the specification required that: (a) the bottom of the fire water storage tank be coated with Koppers Co. Bitumastic No. 505 compound or approved equal; (b) dry film thickness testing be conducted, and (c) paint coverage verification be conducted by visual examination in regard to coverage and freedom from surface defects.
- The staff reviewed drawing 12210-EC-55A-2 and noted that: (a) there is a sand bed below the fire water storage tank's bottom plates; (b) the tank bottom is sloped downward toward the tank bottom to concrete interface; (c) there is an internal lip on the



inside ring of the fire water storage tank foundation where water could accumulate through the thickness of sand; and (d) it does not appear that there is any caulking or sealant around the tank bottom to concrete interface.

- The staff reviewed Work Orders 52703912, 52748470, 52762725, and 52768578 and noted that all 90 sprinklers (two sets of inspection results for each) met acceptance criteria.
- The staff reviewed Work Order 52481488 and noted that the test results stated, “[t]est connection piping is rusted out alarm did not ring.” It also stated, “hole in piping.”
- The staff reviewed CR-RBS-2016-7680 and noted that the applicant stated that: (a) the internal coating blistering was predominately on the tank bottom surfaces, (b) the blisters are predominately intact and “resists flaking and breakaway,” (c) no pitting was observed where the blisters were removed, (d) ultrasonic thickness measurements were taken in four quadrants with no locations below minimum wall thickness, (e) the internal surfaces of the tanks are provided with impressed current cathodic protection, (f) the coating, “does not float,” and (g) the velocity of water flowing to the 14-inch nozzle is very low.
- The staff reviewed Work Orders 00250692 and 00242146 and noted that the inspection results stated that no significant degradation was noted for one tank and the protective coating is in good condition for the other tank.
- The staff reviewed drawing EB-006A and noted that the flame arrestors for the diesel fuel oil storage tanks for the diesel-driven fire water pumps are located in a vertical orientation such that moisture (e.g., condensation, rain water) would not accumulate at the copper-to-steel interface between the arrestor and the connecting piping.
- The staff reviewed Work Order 52423280 and the associated procedure, FPP-0113, and noted that 95 locations are tested; encompassing the: radwaste, turbine, auxiliary boiler and water treatment, outage support, auxiliary control, normal switchgear, and service buildings as well as warehouses and a tunnel between several of the buildings. Step 1.1.2 states, “[p]artially open each hose station valve to verify valve operability and no flow blockage.” Steps 8.5.4 and 8.5.5 state, “[a]llow two to three gallons of water to flow into container and verify that flow is free of any blockage.”
- The staff reviewed Work Order 52660042 and the associated procedure, STP-251-3601, and confirmed that all of the deluge sprinkler systems listed in Enhancement No. 2 are addressed in the plant-specific nozzle inspection procedure. However, this procedure also includes several other deluge sprinkler systems that are not included in the enhancement; for example, systems protecting components in the turbine, auxiliary control, and fire protection buildings. LRA Section 2.4.3 states that these buildings provide physical support, shelter, and protection for structures, systems, and components that have intended functions consistent with 10 CFR 54.4.
- During the operating experience audit, the staff reviewed CR-RBS-2009-2516, CR-RBS-2010-6444, CR-RBS-2010-1240, CR-RBS-2012-4629, CR-RBS-2014-5761, CR-RBS-2016-4759, and CR-RBS-2016-8305; as well as several condition reports related to the piping downstream of the jockey pump (CR-RBS-2012-1511) and noted that there have been many instances of through-wall leakage in fire water system piping.
- During the operating experience audit, the staff reviewed CR-RBS-2010-0160, CR-RBS-2011-6297, CR-RBS-2014-4979, and CR-RBS-2016-4235 and noted that there have been several instances of partial flow blockage or evidence of buildup of sediment or corrosion products in fire water system piping.

During the audit of the “operating experience” program element, the staff’s independent database search identified operating experience that indicates that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER. In light of the plant-specific operating experience, and in order to determine whether the applicant’s license renewal application AMP can be adequate to manage the associated aging effects, the staff will consider issuing RAIs for the subjects discussed below:

- LRA Section 3.3.2.2.8 states, “[a] review of 10 years of plant operating experience identified no conditions of recurring internal corrosion (RIC) as defined in LR-ISG-2012-02, Section A, in the piping components of the auxiliary systems in the scope of license renewal.” However, during its review of plant-specific operating experience, the staff reviewed eight condition reports, as well as several condition reports related to the piping downstream of the jockey pump, and noted that there have been many instances of through-wall leakage in fire water system piping. It is not clear to the staff that the evaluation of recurring internal corrosion in auxiliary systems was consistent with SRP-LR Section 3.3.2.2.8. The staff’s evaluation of the response to this RAI will be documented in SER Section 3.3.2.2.8.
- Based on the staff’s review of pictures attached to the inspection results for the 2016 internal visual inspection of the fire water storage tanks, the coatings do not meet the acceptance criterion that blisters are limited to a few intact small blisters. The 2016 inspections could satisfy the GALL Report AMP XI.M42 recommendation to conduct a baseline inspection 10 years prior to the period of extended operation. If that is the case, the staff lacks sufficient information to conclude that the corrective actions associated with the 2016 inspection results or any other inspections conducted prior to the period of extended operation will be consistent with the “corrective actions” program element of GALL Report AMP XI.M42. Lacking consistency with the “corrective actions” program element or a cited exception to the recommendations accompanied by an adequate basis, the staff lacks a basis to establish reasonable assurance that the fire water storage tanks will meet their intended function during the period of extended operation.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff found insufficient information to determine whether the description provided in the updated safety analysis report supplement was an adequate description of the license renewal application AMP. In order to verify the sufficiency of the updated safety analysis report supplement program description, the staff will consider issuing an RAI for the subject discussed below.

- LRA Section A.1.20 states the training and qualification requirements for coating inspectors associated with coating inspections for the fire water storage tank. LRA Table 3.3.2-7, “Fire Protection – Water System Summary of Aging Management Evaluation,” cites managing loss-of-coating integrity for internally coated piping and piping components. The licensing basis for this program for the period of extended operation may not be adequate if the applicant does not incorporate the training and qualification requirements for coating inspectors for internally coated piping and piping components in the fire water system.

### License Renewal Application AMP B.1.20, “Fire Water System,” Onsite Audit

Audit Activities. During its audit, the staff conducted a walkdown of the fire water storage tanks and made the following observations:

- there is an approximately 3/8-inch thick layer of grout installed at the tank to concrete interface;
- the grout is missing in some locations;
- at one location where the grout is missing, a fibrous material was detected approximately ½-inch inside the tank bottom ring;
- there is no caulking or sealant applied at the tank-to-concrete interface; and
- there was no evidence of lack of coating integrity or loss of material on the tank sides.

### License Renewal Application AMP B.1.21, “Flow-Accelerated Corrosion”

Summary of Information in the Application. The LRA states that AMP B.1.21, “Flow-Accelerated Corrosion,” is an existing program with enhancements that will be consistent with the program elements in GALL Report AMP XI.M17, “Flow-Accelerated Corrosion,” as modified by LR-ISG-2012-01, “Wall Thinning Due to Erosion Mechanisms.” To verify this claim of consistency, the staff audited the license renewal application AMP. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER. During the audit, the staff evaluated the enhancements and will document this in the SER.

Audit Activities. During its audit, the NRC 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 following keywords: cavit, FAC, flow accelerated corrosion, min wall, and piping.

The table below lists the documents that the staff reviewed and found to be relevant during the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
RPS-EP-15-00003	Operating Experience Review Results – Aging Management Program Effectiveness, Section 3.1.18, Flow-Accelerated Corrosion Program	Revision 1
RPS-EP-15-00007	Aging Management Program Evaluation Results, Non-Class 1 Mechanical, Section 4.8 Flow-Accelerated Corrosion	Revision 0
SEP-FAC-RPS-001	Flow-Accelerated Corrosion (FAC) Program Section	Revision 000
CEP-FAC-001	Flow-Accelerated Corrosion Program Component Scanning and Gridding Standard	Revision 0
EN-DC-315	Flow-Accelerated Corrosion Program	Revision 22
RBS-EP-11-00005	River Bend Station Flow-Accelerated Corrosion System Susceptibility Evaluation Report	Revision 0
RBS-EP-11-00006	River Bend Station Flow-Accelerated Corrosion Susceptible Non-Modeled Program Report	Revision 0
RBS-EP-11-00007	River Bend Station Flow-Accelerated Corrosion Program RF16 Post Outage Report	Revision 0
EC-0000044659	RBS RF17 Flow-Accelerated Corrosion Program Outage Report	Revision 000

Document	Title	Revision / Date
EC-RBS-0000058296	RBS RF18 Flow-Accelerated Corrosion Program Post Outage Report	Revision 000
EC-RBS-0000072133	RF19 FAC Post-Outage Report	Revision 000
CR-RBS-2009-04977	FAC Item 410 (FWS009035RL1) located on line FWS-012-035 has required minimum wall thickness of 0.736. Current measured wall thickness is 0.744. This is an ASME Class 1 component and is acceptable based on 14 months for Cycle 16	10/03/2009
CR-RBS-2010-00610	2009 EPRI reported bug in CHECWORKS software that affects all versions. Bug only affects modeled pipe where partial replacements have occurred.	02/04/2010
CR-RBS-2010-03404	Evaluating OE30018, "unit shutdown due to cavitation induced leak in core spray piping" All RBS ECCS min flow piping downstream of an orifice was analyzed. OE is applicable where high velocities (>20fps) exist. Five have >20 (20.9fps) and five have near 20 (18.88fps).	07/27/2010
CR-RBS-2011-01709	FAC Item 412 Class 1 Feedwater elbow reading is 1.325. Tcrit = 1.461 Tnom = 1.788 (low reading appears to be counter bore on the elbow side of weld but pipe clamp prevents further readings to be taken.	02/02/2011
CR-RBS-2013-01348	FAC Item 219 (CNM027076EL1) expanding elbow on line CNM-030-085 not acceptable. A very localized area (1 inch by 1 inch) contains a low reading of 0.350 inches at the toe of the weld in the downstream attached piping. Additional engineering analysis should be performed to accept the component or repair degraded area.	02/22/2013
CR-RBS-2015-05024	Ran with MSR out of service for 2 weeks due to a steam leak on manway Increased potential for FAC and erosion due to extended operation of normally isolated lines. Recommends inspections of specific components.	07/14/2015
CR-RBS-2015-08248	Potential valve leak: Perform FAC inspection on downstream piping DTM-004-151 during RF19 or next shutdown. Perform FAC inspection on condenser connection 29 during RF19.	11/17/2015

During the audit, the staff verified that the "preventive actions," "parameters monitored or inspected," and "monitoring and trending" program elements of the license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP, as modified by LR-ISG-2012-01. During the audit, the staff identified an exception associated with the "scope of program," program element. In addition, the staff found that for the "detection of aging effects" and "acceptance criteria" program elements, there was insufficient information to determine whether they are consistent with the corresponding program elements of the GALL Report AMP. In order to verify whether 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 license renewal application AMP states that the RBS program ensures structural integrity of piping as described in EPRI NSAC-202L-R4. Since the GALL Report AMP recommends that the program uses NSAC-202L-R2 or R3, this staff will evaluate the identified exception in the SER.

- The "detection of aging effects" program element of the license renewal application AMP cites procedure EN-DC-315, "Flow-Accelerated Corrosion Program," as the basis for being consistent with the GALL Report AMP. EN-DC-315 states that specific software (CHECWORKS and FAC Manager Web Edition) shall be used in determining the remaining component life. Based on the breakout session discussions, both software programs are classified as Level C. For safety-related components, it is not

clear to the staff that the work is being properly documented, as provided in NSAC-202L, because the wear rate values are taken from Level C software (CHECWORKS and FAC Manager Web Edition), which typically does not require verification/validation, and the wear rate values are not independently verified.

- The “acceptance criteria” program element of the license renewal application AMP states that the number of refueling cycles remaining before the component reaches the minimum allowable wall thickness is calculated using inspection results. Based on several notes in the post outage flow-accelerated corrosion reports, leaking valves during operation prompted inspections during the next refueling outage. Based on the staff’s review of the flow-accelerated corrosion evaluation documentation, the measured wear rate was calculated based on the total hours in service (approximately 26 years). It was not clear to the staff that the program’s wear rate calculation (for determining the remaining component life) sufficiently accounts for the limited duration of the leaking valves to provide realistic wear rates in this situation.

During the audit of the “operating experience” program element, the staff’s independent database search identified no operating experience that indicates the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER. The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program and verified this description is consistent with the description provided in the SRP-LR.

#### **License Renewal Application AMP B.1.22, “Inservice Inspection”**

Summary of Information in the Application. The LRA states that AMP B.1.22, “Inservice Inspection,” is an existing program that will be 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 license renewal application AMP. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists documents that the NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. RBS B.1.22	Program Basis Document, License Renewal Program Book – Inservice Inspection	Revision 0
2. EN-FAP-LR-007	Evaluation of Aging Management Programs	Revision 6
3. CR-RBS-2002-01401	Enhanced VT-2 on Weld, and Accessibility Issues	03/27/2003
4. CR-RBS-2002-00255	Indications Detected in Weld in RCIC During Mag Particle Examinations	02/12/2002
5. CR-RBS-2007-05190	Class 2 Weld Under-counted by 354 Welds	11/20/2007
6. CR-RBS-2013-05645	Missed Inspection on Internals Weld 6-1a	08/28/2013
7. CR-RBS-2013-06927	Miss-identified Weld Resulted Erroneous OAR-1 Submitted	11/04/2013
8. CR-RBS-2014-02350	Reactor Vessel Head Flange leakoff Line Not Inspected. Potential Code Non-compliance	05/13/2014
9. CR-RBS-2015-03160	Incorrect Database Resulted Miss-counted Class 3 Cat D-A Welds. Resulted Fewer Welds Being VT Examined During Intervals 1 and 2. Code Compliance Issue.	04/28/2015
10. CR-RBS-2015-0577	Incorrect Database Resulted Miss-counted Support Attachments. Resulted Fewer Supports Being VT Examined During Intervals 1 and 2. Code Compliance Issue	07/15/2015
11. RBG-47100	Inservice Inspection Plan for the Third 10-year Interval	01/17/2011
12. RBG-47729	Resubmittal of Owner’s Activity Report	01/09/2017
13. ML010430333	NRC Inspection Report 05000458/2008002	05/09/2008
14. LO-RLO-2011-00108	Containment Inservice Inspection Focused Assessment	12/03/2011
14. LO-RLO-2011-00039	Performance Snapshot Assessment - Inservice Inspection Activities	02/23/2016

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 license renewal application 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, there was insufficient information to determine whether it was consistent with the corresponding program element of the GALL Report AMP. In order 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.

- During the review and audit, the staff noticed a number of cases that the applicant misidentified, miscounted or undercounted welds in its Inservice Inspection Program inspection scope. Discussion with the applicant revealed that the applicant corrected the

subject issues but did not provide evidence that would indicate any program improvement, such that, there is program and procedure control to prevent similar deficiencies. The staff needs demonstration of programmatic control to ensure that the ISI IWB, IWC, and IWD inspections are performed in accordance with the program scope.

During the audit of the “operating experience” program element, the staff’s independent database search did not identify any operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

**License Renewal Application AMP B.1.23, “Inservice Inspection—IWF”**

Summary of Information in the Application.

The LRA states that AMP B.1.23, “Inservice Inspection – IWF,” is an existing program with enhancements that will be 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 license renewal application AMP. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER. During the audit the staff reviewed the enhancements associated with this AMP. Staff will evaluate these enhancements in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
RBS-EP-15-00003	Operating Experience Review Results – Aging Management Program Effectiveness.	Revision 1
CEP-NDE-0903	VT-3 Examination.	07/20/2009
EN-DC-141	Nuclear Management Manual – Design Inputs.	Revision 15
EN-MA-145	Nuclear Management Manual – Maintenance Standard for Torque Applications.	Revision 8
SEP-CISI-RBS-001	Program Section for ASME Subsection XI, Division I, RBS Containment Inservice Inspection (CISI) Program.	04/24/2013
SEP-ISI-RBS-001	Program Section for ASME Section XI, Division I, Inservice Inspection Program.	02/13/2013
RBS-EP-15-00008	Aging Management Program Evaluation Report Civil/Structural.	Revision 1

During the audit, the staff verified that the “scope of program,” “monitoring and trending,” and “acceptance criteria” program elements of the license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP.

In addition, the staff found that for the “preventive actions,” “parameters monitored or inspected,” and “detection of aging effects,” program elements, there was insufficient information to determine whether they were consistent with the corresponding program

elements of the GALL Report AMP. In order to verify whether these program elements are consistent with the corresponding program elements of the GALL Report AMP, the staff will consider issuing an RAI for the subjects discussed below.

The “preventive actions,” “parameters monitored or inspected,” and “detection of aging effects” program elements of the license renewal application AMP state that since plant procedures prohibit the use of molybdenum disulfide lubricants for high-strength bolting greater than 1 inch in diameter, stress corrosion cracking is not a plausible aging effect. The “detection of aging effects” program element in GALL Report AMP XI.S3 recommends that, for high-strength structural bolting (actual measured yield strength greater than or equal to 150 ksi) in sizes greater than 1-inch nominal diameter (hereafter referred to as high-strength bolting), volumetric examinations should be performed in addition to VT-3 visual examinations to detect cracking due to stress corrosion cracking. These volumetric examinations may be waived with adequate plant-specific justification. Additionally, the GALL Report AMP XI.S3 for aging management of high-strength structural bolting recommends the following:

- In the “scope of program” program element, the inclusion of high-strength structural bolting
- In the “preventive actions” program element, (1) the use of bolting material that has an actual measured yield strength less than 150 ksi and (2) prohibition of the use of molybdenum disulfide (MoS<sub>2</sub>) as a thread lubricant due to its potential contribution to stress corrosion cracking (SCC)
- In the “parameters monitored or inspected” program element, monitoring of high-strength structural bolting susceptible to stress corrosion cracking, for cracking

While the GALL Report specifically states that the use of MoS<sub>2</sub> lubricants as a lubricant is a potential contributor to stress corrosion cracking in high-strength bolts, the GALL Report does not limit MoS<sub>2</sub> thread lubricant as the only contributor to the aging mechanism for stress corrosion cracking in the above-mentioned high strength bolts. It is not clear to the staff that the applicant provided an adequate basis to waive volumetric examination of high-strength structural bolting (actual measured yield strength of 150 ksi) in sizes greater than 1 inch nominal diameter because a justification to waive volumetric examinations of high-strength bolts based solely on the prohibition of MoS<sub>2</sub> lubricants does not fully account for cracking of high-strength bolting in environments conducive to stress corrosion cracking.

During the audit of the “operating experience” program element, the staff’s independent database search identified no operating experience indicating that the AMP may not be adequate to manage the associated aging effects.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.



**License Renewal Application AMP B.1.24, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems.”**

Summary of Information in the Application. The LRA states that AMP B.1.24, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems,” is an existing program with enhancements that will be consistent with the program elements in GALL Report AMP XI.M24, “Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems.” To verify this claim of consistency, the staff audited the license renewal application AMP. During the audit, the staff reviewed the enhancements associated with this AMP. The staff will evaluate these enhancements in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
RBS-EP-15-00008	Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems, River Bend Station License Renewal Project Aging Management Program Evaluation Report (AMPER) Civil/Structural	Revision 0
Program Book LRA B.1.24	LRA Appendix A, in B.1.24 Inspection of Overhead Heavy Load and Light Load Handling Systems Program Book, RBS Nuclear Plant	2017
RBS-CS-07-00001	Engineering Report: NEI Heavy Load Drop Initiative (Includes NUREG-0612 Assessment).	12/18/2007
RBS-CS-15-00001	Engineering Report: AMR of the Reactor Building	Revision 1
RBS-CS-15-00003	Engineering Report: AMR of the Turbine Building, Auxiliary Building, and Yard Structures.	Revision 1
EN-FAP-LR-007	Nuclear Management Manual - Fleet Admin Procedure, Evaluation of AMPs	Revision 6
EN-FAP-LR-012	Nuclear Management Manual - Fleet Admin Procedure, OE Review for LR	Revision 5
SDRD-S62 J.O.No. 16138.11 File No. 201.020	Fuel Building, Structural Design Requirements, River Bend, Gulf States Utilities	Revision 0
SDRD-S2 J.O.No. 16140.13 File No. 202.010	Turbine Building, Structural Design Requirements, River Bend, Gulf States Utilities.	Revision 0
SDRD-S42 J.O.No. 16138.11 File No. 202.090	Radwaste Building, Structural Design Requirements, River Bend, Gulf States Utilities.	Revision 0
SDRD-S66 J.O.No. 16140.13 File No. 201.030	Auxiliary Building, Structural Design Requirements, River Bend, Gulf States Utilities.	Revision 0

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 license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit, the staff identified an additional enhancement (difference) associated with the “parameters monitored or inspected,” program element. This difference further enhances the

applicant's program element to monitor deformation and cracking of crane rails and bridge, trolley, and hoist structural components beyond the guidelines provided in the GALL Report.

During the audit, the staff observed:

- A review of RBS-EP-15-00008 (AMPER) clarified the description of inaccessible cranes noted in RBS LRA Section B.1.24 as those "that are inaccessible due to plant operations or infrequently used." The AMPER further states that the "inaccessible or infrequently used cranes and hoists will be inspected prior to use including crane rails and structural components." The staff notes that this is consistent with the guidelines of ASME B30.2.
- A discussion of LRA Appendix A.1.24 in the Program Book indicated that plant procedures are being revised consistent with the AMP enhancements to specify as unacceptable the following conditions:
  - Loss of material due to corrosion or wear that reduces the load bearing capacity of component supports.
  - Debris, dirt, or excessive wear that prevents or restricts sliding as intended on supports.
  - Cracked/shear bolts including anchors and high strength bolts.

During the audit of the "operating experience" program element, the staff's independent database search identified no operating experience indicating that the AMP may not be adequate to manage the associated aging effects.

The staff also audited the updated safety analysis report supplement's description of the LRA aging management program. The staff verified this description consistent with the description provided in the SRP-LR.

### **License Renewal Application AMP B.1.25, "Internal Surfaces in Miscellaneous Piping and Ducting Components"**

Summary of Information in the Application. The LRA states that AMP B.1.25, "Internal Surfaces in Miscellaneous Piping and Ducting Components," is a new program that will be consistent with the program elements in GALL Report AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components," as modified by LR-ISG-2012-02, "Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion under Insulation." To verify this claim of consistency, the staff audited the license renewal application AMP. Because the applicant had not yet fully developed the documents necessary to implement this new program, the staff's audit addressed only the program elements described in the applicant's basis document and a search of plant-specific operating experience. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC 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 following keywords: biofoul, crack, corrosion, wall loss, through wall, piping, foul, leak, and loss of material.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
RBS-EP-15-00007	Aging Management Program Evaluation Results Non Class 1 Mechanical, Internal Surfaces in Miscellaneous Piping and Ducting Components, Section 3.4, “Internal Surfaces in Miscellaneous Piping and Ducting Components”	Revision 0
RBS-EP-15-00003	Operating Experience Review Results – Aging Management Program Effectiveness, Section 3.2.4, “Internal Surfaces in Miscellaneous Piping and Ducting Components”	Revision 1

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 license renewal application 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, there was insufficient information to determine whether the element is consistent with the corresponding program element of the GALL Report AMP. In order to verify whether 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 program description in the license renewal application AMP, associated with the “parameters monitored or inspected” program element, states for metallic components, visual inspection will be used to detect evidence of loss of material and reduction of heat transfer. The GALL Report AMP states for metallic components, visual inspection will be used to detect evidence of loss of material. It is not clear to the staff that these statements are consistent because (a) the GALL Report AMP does not include reduction of heat transfer as an aging effect being managed by this program, and (b) LRA Tables 3.3.2-9, “Combustible Gas Control,” 3.3.2-10, “Standby Diesel Generator,” 3.3.2-11, “HPCS Diesel Generator,” 3.3.2-12, “Control Building HVAC,” and 3.3.2-16, “Plant Drains,” state that cracking will be managed for stainless steel components using this program.

During the audit of the “operating experience” program element, the staff’s independent database search did not identify any operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR, as modified by LR-ISG-2012-02.

**License Renewal Application AMP B.1.26, “Masonry Wall”**

Summary of Information in the Application. The LRA states that AMP B.1.26, “Masonry Wall,” is an existing program with enhancements that will be consistent with the program elements in GALL Report AMP XI.S5, “Masonry Walls.” To verify this claim of consistency, the staff audited the license renewal application AMP. During the audit, the staff reviewed the enhancements associated with this AMP. The enhancements are evaluated in the SER.

**Audit Activities.** During its audit, the NRC 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 following keywords: CMU, concrete, crack, mortar, masonry, and spall.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
1. N/A	River Bend Station Nuclear Plant – B.1.26 Masonry Wall Program Book	
2. RBS-EP-15-00003	Entergy Nuclear Engineering Report: Operating Experience Review Results – Aging Management Program Effectiveness	Revision 2 / 6/20/17
3. RBS-EP-15-00008	Entergy Nuclear Engineering Report: Aging Management Program Evaluation Results – Civil / Structural	Revision 1 / 4/3/17
4. EN-DC-150	Entergy Nuclear Management Manual – Condition Monitoring of Maintenance Rule Structures	Revision 9
5. STP-000-3602	River Bend Station Operating Manual – Surveillance Test Procedure – Fire Barrier Visual Inspection	Revision 15 / 8/27/14
6. CR-RBS-2014-05443	Cracks Found in Mortar	10/28/14
7. CR-RBS-2010-05073	Small Surface Mortar Crack	10/6/10
8. CR-RBS-2016-04092	Hairline Cracking on Exterior Concrete Wall	5/31/16

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 license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff’s independent database search identified no operating experience indicating that the AMP may not be adequate to manage the associated aging effects. The SER will contain the staff’s evaluation of the identified plant-specific operating experience.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

**License Renewal Application AMP B.1.27, “Non-EQ Electrical Cables Connections”**

Summary of Information in the Application.

The LRA states that AMP B.1.27, “Non-EQ Electrical Cable Connections,” is a new condition monitoring program that will be 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 license renewal application AMP. At the time of the audit, the applicant had not yet fully developed the documents necessary to implement this new program, and the staff’s audit addressed only the program elements described in the applicant’s basis document (Aging

Management Program Evaluation Results – Electrical), and operating experience. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC 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 following keywords: cable connection, increased resistance, discoloration, thermal cycling, ohmic heating, vibration, chemical contamination, corrosion, and oxidation.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
RBS-EE-15-00001	River Bend Station License Renewal Project Electrical Screening and Aging Management Review	Revision 1
RBS-EP-15-00002	RBS License Renewal Project Operating Experience Review Results - AERM	Revision 1
RBS-EP-15-00003	RBS License Renewal Project Operating Experience Review Results – Aging Management Program Effectiveness	Revision 2
RBS-EP-15-00010	RBS License Renewal Project Aging Management Review Summary	Revision 1
RBS-EP-15-00009	RBS License Renewal Project Aging Management Program Evaluation Results – Electrical	Revision 1
EN-FAP-LR-005	Fleet Administrative Procedure Electrical Systems Scoping, Screening and Aging Management Reviews	Revision 6
LRA-EE-001A	River Bend Nuclear Station Offsite Power Recovery Diagram	12/01/2015
EN-FAP-LR-026	License Renewal Non-EQ Electrical Cable Connection AMP	Revision 4

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

During the audit of the “operating experience” program element, the staff’s independent database search identified no operating experience indicating that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

**License Renewal Application AMP B.1.28, “Non-EQ Inaccessible Power Cables (>400V)”**

Summary of Information in the Application.

The LRA states that AMP B.1.28, “Non-EQ Inaccessible Power Cables (>400V),” is a new condition monitoring program that will be 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 license renewal application AMP. At the time of the audit, the applicant had not yet fully developed the documents necessary to implement this new program, and the staff’s audit addressed only the program elements described in the applicant’s basis document (Aging Management Program Evaluation Results – Electrical), and operating experience. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of several electrical manholes in the area of transformer bays, north side access road near cooling towers, Fancy Point switchyard, and observed inspection and water removal of electrical manhole EMH-103. The staff also conducted an independent search of the applicant’s operating experience database using the following keywords: cable, manhole, submergence, insulation, sump, sump pump, tan delta, degraded cable, and vault.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
RBS-EE-15-00001	River Bend Station License Renewal Project Electrical Screening and Aging Management Review	Revision 1
RBS-EP-15-00002	RBS License Renewal Project Operating Experience Review Results - AERM	Revision 1
RBS-EP-15-00003	RBS License Renewal Project Operating Experience Review Results – Aging Management Program Effectiveness	Revision 2
RBS-EP-15-00010	RBS License Renewal Project Aging Management Review Summary	Revision 1
RBS-EP-15-00009	RBS License Renewal Project Aging Management Program Evaluation Results – Electrical	Revision 1

Document	Title	Revision / Date
EN-FAP-LR-005	Fleet Administrative Procedure Electrical Systems Scoping, Screening and Aging Management Reviews	Revision 6
LRA-EE-001A	River Bend Nuclear Station Offsite Power Recovery Diagram	12/01/2015
CR-RBS-2012-01591	Cable failed Tan Delta test acceptance criteria per W.O.52389658	02/29/2012
CR-RBS-2014-03068	During inspection, manhole EMH610 was found with 94" of water and in contact with cables (W.O.52561529-01)	06/25/2014
CR-RBS-2014-02825	During inspection, manhole EMH602 was found with 106" of water and in contact with cables (W.O.52561532-01)	06/10/2014
CR-RBS-2015-01765	Outside operator noticed water flowing into electrical manhole. NRC informed	03/07/2015
CR-RBS-2011-01311	Tan Delta test results showed cable in degraded condition. Consultation with SME and EPRI determined replacement not needed	04/10/2011
CR-RBS-2012-03590	Cable INPSANJ304 failed Tan Delta test. Water found in cable when cable was cut	05/27/2012
CR-RBS-2013-03834	Manhole EMH36 has been in quarterly trend report due to water intrusion. Issue identified during corrective action QA audit (QA-3-2013-RBS-01)	05/23/2013
CR-RBS-2015-08068	Cable ICWSANK001 phase C failed insulation resistance acceptance criteria (5 meg Ohm vs. 317 meg. Ohm). A new W.R.378544 was generated to repair or replace.	11/09/2015
EN-DC-346	Nuclear Management Manual Cable Reliability Program	Revision 6
ECC-31753	Engineering Change document (manhole sump modification)	Revision 0

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 license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP.

In addition, the staff found that for the "preventive actions" and "corrective actions" program elements, there was insufficient information to determine whether they were consistent with the corresponding program elements of the GALL Report AMP. In order to verify whether 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.

- Preventive actions element of the GALL Report AMP XI.E3 includes inspection and operational verification of dewatering devices prior to any known or predicted heavy rain or flooding event. The applicant's proposed program preventive actions statement as described in RBS-EP-15-00009, "Aging Management Program Evaluation Results—Electrical," does not include this recommendation. In order to verify whether this program element is consistent with the corresponding program elements of the GALL Report AMP XI.E3, the staff will consider issuing an RAI.
- Corrective actions element of the GALL Report AMP XI.E3 includes a statement for evaluation to consider the significance of the test or inspection results, the operability of the component, the reportability of the event, the extent of concern, the potential root causes for not meeting the test or inspection acceptance criteria, the corrective actions required, and the likelihood of occurrence. The applicant's proposed program corrective actions element as described in RBS-EP-15-00009, "Aging Management Program Evaluation Results—Electrical," does not include this recommendation. In order to verify whether this program element is consistent with the corresponding program elements of the GALL Report AMP XI.E3, the staff will consider issuing an RAI.

During the audit of the "operating experience" program element, the staff's independent database search identified no operating experience indicating that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER.

The staff also audited the updated safety analysis report supplement's description of the LRA aging management program. The staff found insufficient information to determine whether the description provided in the updated safety analysis report supplement was an adequate description of the license renewal application AMP. In order to verify the sufficiency of the updated safety analysis report supplement program description, the staff will consider issuing an RAI for the subject discussed below.

- Inspection and operational verification of dewatering devices prior to any known or predicted heavy rain or flooding event is not mentioned in the LRA updated safety analysis report supplement as described in SRP-LR.

### **License Renewal Application AMP B.1.29, "Non-EQ Insulated Cables and Connections"**

Summary of Information in the Application. The LRA states that AMP B.1.29, "Non-EQ Insulated Cables and Connection," is a new condition monitoring program that will be 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 license renewal application AMP. At the time of the audit, the applicant had not yet fully developed the documents necessary to implement this new program, and the staff's audit addressed only the program elements described in the applicant's basis document (Aging Management Program Evaluation Results—Electrical), and operating experience. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC 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 following keywords: cable, embrittlement, discoloration, insulation, cracking, melting, swelling, and surface contamination.



The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant's operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
RBS-EE-15-00001	River Bend Station License Renewal Project Electrical Screening and Aging Management Review	Revision 1
RBS-EP-15-00002	RBS License Renewal Project Operating Experience Review Results - AERM	Revision 1
RBS-EP-15-00003	RBS License Renewal Project Operating Experience Review Results – Aging Management Program Effectiveness	Revision 2
RBS-EP-15-00010	RBS License Renewal Project Aging Management Review Summary	Revision 1
RBS-EP-15-00009	RBS License Renewal Project Aging Management Program Evaluation Results – Electrical	Revision 1
EN-FAP-LR-005	Fleet Administrative Procedure Electrical Systems Scoping, Screening and Aging Management Reviews	Revision 6
LRA-EE-001A	River Bend Nuclear Station Offsite Power Recovery Diagram	12/01/2015
EN-DC-348	Non-EQ Insulated Cables and Connection Inspection	11/21/2013

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 license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP.

In addition, the staff found that for the “parameters monitored/inspected” and “corrective actions” program elements, there was insufficient information to determine whether they were consistent with the corresponding program elements of the GALL Report AMP. In order to verify whether 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.

- Parameters monitored/inspected element of the GALL Report AMP XI.E1 recommends to inspect all assessable electrical cables and connections installed in adverse localized environments. The applicant's proposed corresponding program element as described in RBS-EP-15-00009, “Aging Management Program Evaluation Results – Electrical” states that samples of accessible cable will represent, with reasonable assurance, all cables and connections in adverse localized environments. In order to verify whether

this program element is consistent with the corresponding program elements of the GALL Report AMP XI.E1, the staff will consider issuing an RAI.

- Corrective action element of the GALL Report AMP XI.E1 recommends that when an unacceptable condition or situation is identified, a determination is made as to whether the same condition or situation is applicable to inaccessible cables or connections. The applicant's proposed corresponding program element as described in RBS-EP-15-00009, "Aging Management Program Evaluation Results – Electrical" states that when an adverse localized environment is identified for the insulation material of a cable or connection, a determination will be made as to whether the same condition or situation is applicable to other accessible or inaccessible cable or connection. In order to verify whether this program element is consistent with the corresponding program elements of the GALL Report AMP XI.E1, the staff will consider issuing an RAI.

During the audit of the "operating experience" program element, the staff's independent database search did not identify any operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER.

The staff also audited the updated safety analysis report supplement's description of the LRA aging management program. The staff found insufficient information to determine whether the description provided in the updated safety analysis report supplement was an adequate description of the license renewal application AMP. In order to verify the sufficiency of the updated safety analysis report supplement program description, the staff will consider issuing an RAI for the subject discussed below.

In the LRA updated safety analysis report supplement, the applicant states that this program sample of accessible cable will represent, with reasonable assurance, all cables and connections in adverse localized environments. It appears that sampling of accessible cables and connections in adverse localized environments is not consistent with the description of program in SRP-LR. Table 3.0-1 of SRP-LR states that the program consists of accessible electrical cable and connections installed in adverse localized environments to be visually inspected.

#### **License Renewal Application AMP B.1.30, "Non-EQ Sensitive Instrumentation Circuits"**

Summary of Information in the Application. The LRA states that AMP B.1.30, "Non-EQ Sensitive Instrumentation Circuits Test Review," is a new performance monitoring program that will be consistent with the program elements in GALL Report AMP XI.E2, "Insulated 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 license renewal application AMP. At the time of the audit, the applicant had not yet fully developed the documents necessary to implement this new program, and the staff's audit addressed only the program elements described in the applicant's basis document (Aging Management Program Evaluation Results – Electrical) and operating experience.

Audit Activities. During its audit, the NRC staff interviewed the applicant's staff and reviewed onsite documentation that the applicant provided. In addition, the staff conducted walkdowns of the reactor building, main control room, and switchgear room areas, and observed several radiation monitors. The staff also conducted an independent search of the applicant's operating experience database using the following keywords: intermediate range monitor, power range

monitor, source range monitor, instrumentation circuits, replace cable, neutron flux, and electrical insulation.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant's operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
RBS-EE-15-00001	River Bend Station License Renewal Project Electrical Screening and Aging Management Review	Revision 1
RBS-EP-15-00002	RBS License Renewal Project Operating Experience Review Results – AERM	Revision 1
RBS-EP-15-00003	RBS License Renewal Project Operating Experience Review Results – Aging Management Program Effectiveness	Revision 2
RBS-EP-15-00009	RBS License Renewal Project Aging Management Program Evaluation Results – Electrical	Revision 1
RBS-EP-15-00010	RBS License Renewal Project Aging Management Review Summary	Revision 1
EN-DC-348	Non-EQ Insulated Cables and Connection Inspection	11/21/2013
EN-DC-346	Cable Reliability Program	11/21/2013
CR-RBS-2004-01838	Neutron Monitoring Instrumentation noise caused by loose coaxial cable connection.	06/19/2004
CR-RBS-2010-02318	INPO issued SEE-IN Topical Report TR10-69 – Cable Aging and Monitoring on May 11, 2010.	05/20/2010

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

During the audit of the “operating experience” program element, the staff's independent database search did not identify any operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER.

The staff also audited the updated safety analysis report supplement's description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

### License Renewal Application AMP B.1.31, “Oil Analysis”

Summary of Information in the Application. The LRA states that AMP B.1.31, “Oil Analysis,” is an existing program 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 license renewal application AMP.

Audit Activities. During its audit, the NRC 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 following keywords: oil analysis, wear, and loss of material.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
RBS-EP-15-00007	Aging Management Program Evaluation Results - Non-Class 1 Mechanical	Revision 0
RBS-EP-15-00003	Operating Experience Review Results – Aging Management Program Effectiveness, Section 3.1.23, Oil Analysis Program	Revision 1
EN-DC-159	System and Component Monitoring	Revision 8
EN-LI-121	Trending and Performance Review Process	Revision 20
EN-DC-310	Predictive Maintenance Program	Revision 6

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 license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit, the staff observed:

- The LRA description does not include any information for trending data. However, after reviewing RBS-EP-15-00007, the staff was able to verify that the LRA AMP B.1.31, “Oil Analysis” program does trend the results of the analysis performed on in-scope components.

During the audit of the “operating experience” program element, the staff’s independent database search did not identify any operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff’s evaluation of the identified plant-specific operating experience will be addressed in the SER.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

### **License Renewal Application AMP B.1.32, “One-Time Inspection”**

Summary of Information in the Application. The LRA states that AMP B.1.32, “One-Time Inspection,” is a new program that will be consistent with the program elements in GALL Report AMP XI.M32, “One-Time Inspection.” To verify this claim of consistency, the staff audited the license renewal application AMP. At the time of the audit, the applicant had not yet fully developed the documents necessary to implement this new program, and the staff’s audit addressed only the program elements described in the applicant’s basis documents and operating experience. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
RBS-EP-15-00007	Aging Management Program Evaluation Results Non-Class 1 Mechanical, Section 3.5, One-Time Inspection	Revision 0
RBS-EP-15-00003	Operating Experience Review Results-Aging Management Program Effectiveness, Section 3.2.9, One-Time Inspection	Revision 1

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 license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

### **License Renewal Application AMP B.1.33, “One-Time Inspection—Small-Bore Piping Program”**

Summary of Information in the Application. The LRA states that AMP B.1.33, “One-Time Inspection—Small-Bore Piping,” is a new program that will be 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 license renewal application AMP. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists documents that the NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. RBS B.1.33	Program Basis Document, License Renewal Program Book – One-Time Inspection - Small-Bore Piping	Revision 0
2. EN-FAP-LR-007	Evaluation of Aging Management Programs	Revision 6
3. CR-RBS-1993-434	Historical Record	07/24/1993
4. CR-RBS-2001-483	Pin-hole Leak at Welded Plus in Leak-off Line Connection	04/10/2001
5. CR-RBS-1999-1199	Steam Leak on Drain Line Socket Weld	07/20/1999
6. CR-RBS-2010-1844	Leak Found in Tie-in Line	04/22/2010
7. LER-458-1997-002	Through-wall Crack in Weld on RRS Reactor Recirculation System Vent Valve	10/27/1997

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 license renewal application 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 whether it was consistent with the corresponding program element of the GALL Report AMP. In order 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.

- LRA Section B.1.33 does not provide the total population of welds for each weld type or the total number of these welds that will be included in the volumetric examinations. During the safety review and audit, the staff noted that the number of socket welds estimated by the applicant is unusually low compared to similar plants. The staff is concerned that the inspection may not be adequate if the weld population is under-counted. The staff will request that the applicant provide the number of welds in the population and the basis for the proposed inspection sampling.

During the audit of the “operating experience” program element, the staff’s independent database search did not identify any operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

**License Renewal Application AMP B1.34, “Periodic Surveillance and Preventive Maintenance”**

Summary of Information in the Application. The LRA states that AMP B.1.34, “Periodic Surveillance and Preventive Maintenance [PSPM],” is an existing plant-specific aging management program. The staff audited the license renewal application AMP to determine consistency with SRP-LR Section A.1.2.3, “Aging Management Program Elements.” Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
RBS-EP-15-00007	Aging Management Program Evaluation Results – Non-Class 1 Mechanical Periodic Surveillance and Preventive Maintenance	Revision 0
EN-DC-324	Preventive Maintenance Program	Revision 15
RBS-ME-15-00011	Aging Management Review of the Plant Drains System	Revision 1

During the audit, the staff verified that the “preventive actions,” “parameters monitored or inspected,” “monitoring and trending,” and “acceptance criteria” program elements of the license renewal application AMP are consistent with SRP-LR Section A.1.2.3.

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 whether they were consistent with SRP-LR Section A.1.2.3. In order to verify whether these program elements are consistent with SRP-LR Section A.1.2.3, the staff will consider issuing RAIs for the subjects discussed below.

- The “scope of program” program element of the PSPM program states that loss of material for flexible hoses in the process radiation monitoring system will be managed by the PSPM program; however, LRA Table 3.3.2-18-17 does not cite any aging management review items for flexible hoses. In addition, the PSPM program will manage loss of material for stainless steel piping, pump casings, sight glasses, tubing, heat exchanger and valve bodies exposed to waste water located in the process radiation monitoring system. Cracking is not managed for these components; however, cracking is managed for other stainless steel components (i.e., pump casing, piping) exposed to waste water in the plant drains system by the PSPM program (LRA Table 3.3.2-16). SRP-LR Section A.1.2.3.1 recommends that the scope of the program should include the specific structures and components and the aging effects which the program manages. It is not clear to the staff that these statements are consistent because the LRA is not internally consistent. The inconsistency is an error trap that could lead to not managing all applicable aging effects for these components.
- The “detection of aging effects” program element of the PSPM program: (a) states that the inspection of elastomeric materials is conducted to detect change in material properties; however, LRA Table 3.5.2-1 states that loss of sealing is managed for the inflatable seals for the spent fuel storage and upper containment pool gates and change in material properties is not cited; (b) is silent on the percent of the elastomeric surface that will be physically manipulated; and (c) states that the sample size is dependent on the component’s material and environment and takes into consideration industry and plant-specific operating experience. SRP-LR Section A.1.2.3.4 recommends that: (a) the parameters to be monitored or inspected should be appropriate to ensure that the structure- and component-intended function(s) will be adequately maintained for license renewal under all current licensing basis design conditions; and (b) for a condition monitoring program, when sampling is used to represent a larger population of SCs, applicants should provide the basis for the inspection population and sample size. The LRA is not internally consistent and although the PSPM program is a plant-specific program, there is no basis for not being consistent with the recommendations in other

GALL Report sampling-based programs (e.g., AMP XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components").

During the audit, the staff observed:

- The staff reviewed RBS-ME-15-00011 and noted that the drain pumps have stainless steel strainers bolted directly to the inlet opening.

During the audit of the "operating experience" program element, the staff's independent database search identified operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER. In light of the plant-specific operating experience, in order to determine whether the applicant's license renewal application AMP can be adequate to manage the associated aging effects, the staff will consider issuing an RAI for the subject discussed below.

- During the operating experience audit, the staff reviewed a condition report that documented an adverse trend associated with loss of material in drain lines resulting in partial flow blockage. LRA Table 3.3.2-16, "Plant Drains," cites a strainer with a filtration function. There is no entry citing flow blockage due to fouling as an aging effect requiring management. During its review of LRA Section 2.3.3.16 and Section 9.3.7 of the updated safety analysis report, the staff noted that the pressure boundary function (adequate flow) of piping downstream of plant drain strainers is credited for maintain suppression pool level in the event of emergency core cooling pump or valve seal leakage and to minimize flooding in the event of a crack in the reactor core isolation cooling suction line.

The staff also audited the updated safety analysis report supplement's description of the LRA aging management program. The staff found insufficient information to determine whether the description provided in the updated safety analysis report supplement was an adequate description of the license renewal application AMP. In order to verify the sufficiency of the updated safety analysis report supplement program description, the staff will consider issuing an RAI for the subject discussed below.

- The updated safety analysis report supplement does not include: (a) the periodicity, sample size, and criteria for selecting inspection locations; and (b) that physical manipulation of elastomers be conducted in addition to visual inspections. Although the PSPM program is a plant-specific program, there is no basis for the updated safety analysis report not being consistent with the UFSAR supplement recommendations in other GALL Report sampling-based programs (e.g., AMP XI.M38).

### **License Renewal Application AMP B.1.35, "Protective Coating Monitoring and Maintenance"**

Summary of Information in the Application. The LRA states that the AMP B.1.35, "Protective Coating Monitoring and Maintenance," is an existing program that is consistent with the program elements in GALL Report AMP XI.S8, "Protective Coating Monitoring and Maintenance." To verify this claim of consistency, the staff audited the license renewal application AMP. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.



**Audit Activities.** During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
CR-RBS-2012-07038	Acceptability and Acceptance Criteria for Galvanized Coatings	11/12/2012
CR-RBS-2017-01513	Four Areas of Degraded Coatings in Drywell	02/15/2017
CR-RBS-2016-07893	RF-17 Drywell Coatings Inspection	11/21/2016
CR-RBS-2015-01390	RF-18 Drywell Coatings Inspection	02/27/2015
CR-2000-00904	Potential Impact of Coating Degradation on ECCS Strainers	04/04/2000
Attachment 10035141	Technical Evaluation for CR-2000-00904 (Attachment to CA-2)	04/04/2000

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 license renewal application 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, there was insufficient information to determine whether it was consistent with the corresponding program element of the GALL Report AMP. In order in order to verify whether 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 “detection of aging effects” program element of the license renewal application AMP states that the program provides information and instructions for the documentation and techniques to be used for the inspection of Service Level I coatings in accordance with guidelines identified in EPRI 1019157 and ASTM D 5163-08. The GALL Report AMP recommends that thorough visual inspections shall be carried out on previously designated areas and on areas noted as deficient during the walkthrough. It is not clear to the staff that these statements are consistent because the terminology used to identify deficient coatings are not clearly defined (e.g., damaged, degraded, failed, qualified, unqualified) and it is not clear to the staff how these different classifications of coatings are accounted for in the calculations regarding the maximum allowable values.

During the audit of the “operating experience” program element, the staff’s independent database search identified operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER. In light of the plant-specific operating experience, in order to determine whether the applicant’s license renewal application AMP can be adequate to manage the associated aging effects, the staff will consider issuing RAIs for the subjects discussed below.

- The drywell coating inspection reports for RFO 17 and 18 (RBS-CS-13-00006 and RBS-CS-15-00001) state that the allowed value of unqualified coatings in accordance with site procedure EDP-CS-10 is 2,000 square feet. These reports also state that the maximum allowable failed coatings with respect to the Emergency core cooling system

suction strainers remaining capable of performing their design function is 150,000 square feet. It is not clear to the staff which values are being used to quantify the available margin to ensure operability of post-accident safety systems.

- The staff's review of plant operating experience revealed that degradation of Service Level I coatings exists and the licensee's procedures include actions to evaluate and address this degradation, such as visual inspection and repair. The licensee's procedures state that, in some cases, physical testing may be performed; however, the staff was not able to identify any past physical testing performed by the licensee. It is not clear to the staff how the licensee bounds degradation of Service Level I coatings given that degradation exists and physical testing has not been performed.

The staff also audited the updated safety analysis report supplement's description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

### **License Renewal Application AMP B.1.36, "Reactor Head Closure Studs"**

Summary of Information in the Application. The LRA states that AMP B.1.36, "Reactor Head Closure Studs," is an existing program that will be consistent, with an exception and an enhancement, with the program elements in GALL Report AMP XI.M3, "Reactor Head Closure Studs Program." To verify this claim of consistency, the staff audited the license renewal application AMP.

Audit Activities. During its audit, the NRC staff interviewed the applicant's staff and reviewed onsite documentation that the applicant provided.

The table below lists documents that the NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. RBS B.1.36	Program Basis Document, License Renewal Program Book – Reactor Head Closure Studs	Revision 0
2. EN-FAP-LR-007	Evaluation of Aging Management Programs	Revision 6
3. RBG-47100	Inservice Inspection Plan for the Third 10-year Interval	01/17/2011
4. CR-RBS-2001-1349	Two Depressions Detected on Vessel Flange	10/07/2001

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 license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP. During the audit, the staff reviewed the exception and enhancement associated with "preventive actions," program element of this AMP. The staff will evaluate the exception and enhancement to the AMP in the SER.

During the audit of the "operating experience" program element, the staff's independent database search did not identify any operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects.

The staff also audited the updated safety analysis report supplement's description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

### **License Renewal Application AMP B.1.37, "Reactor Vessel Surveillance Program"**

Summary of Information in the Application. The LRA states that AMP B.1.37, “Reactor Vessel Surveillance” is consistent with the program elements defined in GALL Report AMP XI.M31, “Reactor Vessel Material Surveillance,” with an exception to the program element activities that are defined in the GALL AMP’s “detection of aging effects” program element. To verify this claim of consistency, the staff audited the license renewal application AMP. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER. During the audit, the staff reviewed the exception with this AMP. Staff will evaluate the exception to the GALL Report AMP in the SER.

Audit Activities. During its audit, the NRC 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 following keywords: Part 50, Appendix H, integrated surveillance, ISP, capsule, and BWRVIP-86.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the NRC staff identified them during its search of the applicant’s operating experience database or during its review of the current licensing basis and current design basis for the plant, as well as the applicable program evaluation report for the AMP.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. LRA Appendix B, Section B.1.37	Reactor Vessel Material Surveillance	Revision 0
2. LRA Section 4.2.3	Pressure-Temperature Limits	Revision 0
3. RBS-15-00006	RBS License Renewal Project, Aging Management Program Evaluation Report – Class 1 Mechanical, Reactor Vessel Surveillance	Revision 0
4. EPRI Report No. 1003346	BWRVIP-86-A: BWR Vessel and Internals Project Updated BWR Integrated Surveillance Program (ISP) Implementation Plan (Proprietary Report, ADAMS No. ML023190491)	Revision 0 (-A version)
5. NRC Safety Evaluation	Safety Evaluation Regarding EPRI Proprietary Reports "BWR Vessel and Internals Project, BWR Integrated Surveillance Program Plan (BWRVIP-78)" and BWRVIP-86 - "BWR Vessel and Internals Project, BWR Integrated Surveillance Program Implementation Plan." (Proprietary Evaluation in ADAMS No. ML020380691)	02/01/2002
6. EPRI Report No. 1025144	BWRVIP-86, Revision 1-A: BWR Vessel and Internals Project Updated BWR Integrated Surveillance Program (ISP) Implementation Plan (Proprietary Report, ADAMS Nos. ML13176A098, ML13176A099, ML13176A100) <sup>1</sup>	Revision 1-A
7. NRC Safety Evaluation	Final Safety Evaluation Regarding EPRI Technical Report 1016575, BWRVIP-86, Revision 1. (ADAMS Nos. ML112780497 and ML112780503)	10/20/2011
8. EPRI Report No. 1024452	BWRVIP-94NP, Revision 2: BWR Vessel and Internals Project Program Implementation Guide	Revision 2-NP
9. USAR Section 5.3	Reactor Vessel	Rev. 24

Document	Title	Revision / Date
10. Facility License Amendment 136 to Docket No. 50-458	"River Bend Station, Unit 1 – Issuance of Amendment, RE: Reactor Vessel Material Surveillance Program" (ADAMS No. ML032050454)	07/24/2003
11. EPRI Non-Proprietary Report No. 1021553	"BWRVIP-87NP, Revision 1: BWR Vessel and Internals Project, Testing and Evaluation of BWR Supplemental Surveillance Program Capsules D, G, and H" (ADAMS No. ML102420110)	08/26/2010
12. EPRI Non-Proprietary Report No. 1021555	"BWRVIP-113: BWR Vessel and Internals Project, River Bend 183 Degree Surveillance Capsule Report" (ADAMS No. ML102580248)	09/13/2010
13. EPRI Non-Proprietary Report No. 1021556	"BWRVIP-169: BWR Vessel and Internals Project, Testing and Evaluation of BWR Supplemental Surveillance Program (SSP) Capsules A, B, and C" (ADAMS No. ML102590092)	09/14/2010
14. EPRI Non-Proprietary Report No. 1021554	"BWRVIP- 111, Revision 1: BWR Vessel and Internals Project, Testing and Evaluation of BWR Supplemental Surveillance Program Capsules E, F, and I" (ADAMS No. ML102720220)	09/24/2010
15. CR-RBS-2017-04807	Discrepancy found between SAR and TRM and BWRVIP ISP on capsule pull schedule.	June 19, 2017

1. Publicly available, nonproprietary version of the BWRVIP-86, Revision 1-A report is given in ADAMS ML13176A097.

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 license renewal application AMP consistent with the corresponding elements of the GALL Report AMP. The staff also verified that aspects of the "detection of aging effects," program element not associated with the exception identified in the LRA during the audit are consistent with the corresponding program elements in the GALL Report AMP.

In addition, in LRA Section 4.2.4, the applicant credits its Reactor Vessel Surveillance Program as the basis for disposition the applicant's pressure-temperature limits time-limited aging analysis in accordance with the requirement in 10 CFR 54.21(c)(1)(iii). For this disposition basis, the staff found that the "scope of program" "detection of aging effects," "monitoring and trending," "acceptance criteria", "confirmation process," and "administrative controls program elements of the AMP may need further enhancements in order to justify the applicant's basis for dispositioning the time-limited aging analysis in accordance with 10 CFR 54.21(c)(1)(iii).

In order to verify whether this program element is consistent with the corresponding program elements of the GALL Report AMP, or whether the program needs further enhancements, the staff will consider issuing RAIs for the subjects discussed below.

- **"Scope of Program" and "Detection of Aging Effects":** The Reactor Vessel Surveillance Program defined in LRA Section B.1.37 identifies that the version of the RBS-specific integrated surveillance program (ISP) that will be implemented during the period of extended operation will be based on the methodology in EPRI Proprietary Report BWRVIP-86, Revision 1-A, which was approved by safety evaluation dated October 20, 2011. However, the AMP does not include or define the integrated surveillance program's withdrawal and testing criteria for the RBS-specific license renewal surveillance capsule (ISP(E) capsule) that will be removed during the period of extended operation in accordance with BWRVIP-86, Revision 1-A. Section 5.3.1.6 of the updated safety analysis report states that removal of this capsule can be indefinitely deferred, whereas the BWRVIP-86, Revision 1-A report identifies that this capsule should be removed at an EPRI-specified proprietary time when the capsule is

projected to achieve a EPRI-specified proprietary neutron fluence exposure. These types of details need to be included in the updated safety analysis report supplement for the AMP, particularly when the details for removing, testing, and reporting test results of the RBS license renewal capsule in EPRI proprietary report BWRVIP-86, Revision 1-A differ from those currently defined in Section 5.3.1.6 of the updated safety analysis report for the capsule.

- “Scope of Program,” “Detection of Aging Effects,” “Monitoring and Trending,” “Acceptance Criteria,” “Confirmation Process,” and “Administrative Controls”: In LRA Section 4.2.3, the applicant credits its Reactor Vessel Surveillance Program as the basis for accepting the pressure-temperature limits time-limited aging analysis in accordance with the requirement in 10 CFR 54.21(c)(1)(iii) and for claiming that the aging effect of loss of fracture toughness due to neutron irradiation embrittlement on the intended function(s) of the reactor pressure vessel will be adequately managed during the period of extended operation. For boiling-water reactor plants like RBS that include the current P-T limit curves in the limiting conditions of operation of the plant technical specifications (i.e., TS LCOs), Section 4.2.2.1.3.3 in NUREG-1800, Revision 2, identifies that the 10 CFR 50.90, “Application for Amendment of License, Construction Permit, or Early Site Permit,” process is the proper process for accepting the P-T limits time-limited aging analysis in accordance with 10 CFR 54.21(c)(1)(iii). The program in GALL AMP XI.M31, “Reactor Vessel Materials Surveillance,” does not include any type of monitoring criteria to monitor plant operations against the applicable effective full-power years or calendar expiration dates for existing P-T limit curves in the current licensing basis. Therefore, in order to justify use of this AMP for disposition of the time-limited aging analysis under 10 CFR 54.21(c)(1)(iii), the AMP may need to be amended to include appropriate enhancements of the AMP program elements referenced in this bullet. Otherwise, the applicant will need to provide an alternative basis for dispositioning the time-limited aging analysis under 10 CFR 54.21(c)(1).
- AMP Exception: License renewal application AMP B.1.37, “Reactor Vessel Surveillance Program,” includes one exception taken to the guidance in GALL AMP XI.M31, “Detection of Aging Effects,” program element for removing reactor pressure vessel supplemental surveillance capsules during a proposed period of extended operation. The applicant indicates that the AMP does not meet the GALL AMP’s time criteria for removing these types of capsules and sending the test specimens in the capsule out for vendor testing. The applicant states that the exception is justified because the guidance in Regulatory Guide (RG) 1.99, Revision 2, “Radiation Embrittlement of Reactor Vessel Materials.” includes alternate methods for calculating the reactor pressure vessel upper shelf energy (USE) and  $RT_{NDT}$  values that do not involve the use of relevant reactor pressure vessel surveillance data. The staff observed that the applicant’s basis for taking this exception may not be valid because the removal of the relevant surveillance capsule at RBS would need to be performed in accordance with approved integrated surveillance program (ISP) in the proprietary BWRVIP-86, Revision 1-A report regardless of the existence of the applicable regulatory guide. As a result, justification for taking the exception will need to be made in relation to the approved integrated surveillance program defined in the BWRVIP-86, Revision 1-A report and not the methods of analysis that are defined in RG 1.99, Revision 2, “Radiation Embrittlement of Reactor Vessel Materials.”

During the audit of the “operating experience” program element, the staff’s independent database search identified operating experience that would indicate that the AMP may not be

accounting for all relevant integrated surveillance program surveillance data that is applicable to the RBS reactor pressure vessel and therefore, that the AMP may not be adequate manage loss of fracture toughness due to neutron irradiation embrittlement on the intended functions of the reactor pressure vessel. The staff will evaluate the identified plant-specific operating experience in the SER. In light of the plant-specific operating experience, in order to determine whether the applicant's license renewal application AMP can be adequate to manage the associated aging effect, the staff will consider issuing an RAI for the subject discussed below.

- “Operating Experience”: In the “operating experience” program element for the AMP, the applicant identifies that the relevant surveillance data is from EPRI Report BWRVIP-135. However, the staff noted that the BWRVIP-135 report or its revisions are not BWRVIP integrated surveillance program reports that EPRI BWRVIP submits to the NRC in accordance with the approved integrated surveillance program in EPRI Report No. BWRVIP-86, Revision 1-A. Instead, relevant integrated surveillance program capsule data for the RBS reactor pressure vessel is reported in the following nonproprietary EPRI reports that have been submitted to and included in the NRC's document control desk (as placed into ADAMS): (a) BWRVIP-87NP, Revision 1, (b) BWRVIP-111NP, Revision 1, (c) BWRVIP-113NP, and (d) BWRVIP-169NP. As a result, the staff observed that the applicant did not identify all of the applicable BWRVIP surveillance capsule reports that need to be within the scope of the AMP and the scope of the reactor pressure vessel neutron embrittlement time-limited aging analyses provided in the LRA. Thus, it is not evident that all of the relevant reactor pressure vessel surveillance data currently available for RBS reactor pressure vessel beltline plate made from Heat No. C3054-2 or weld components made from Heat No. 5P6756 have been appropriately accounted for in the AMP.

The staff also audited the LRA updated safety analysis report supplement, Section A.1.37 description of Reactor Vessel Surveillance Program. The staff found insufficient information to determine whether the updated safety analysis report supplement summary provided an adequate description of the license renewal application AMP. In order to obtain information for this verification, the staff will consider issuing an RAI for the subjects or topics discussed below.

- The updated safety analysis report supplement summary description reports that the appropriate surveillance data are given in EPRI BWRVIP-135. This creates a regulatory logistics issue because EPRI does not submit BWRVIP-135 or any of its revisions to the NRC document control desk for inclusion in ADAMS. Although the updated safety analysis report supplement summary appropriately indicates that the program will be modified as future BWRVIP integrated surveillance program reports and data become available, the summary description does not reference EPRI Report Nos. BWRVIP-87NP, Revision 1, BWRVIP-111NP, BWRVIP-113NP, and BWRVIP-169NP as being within the scope of the AMP or that the reports are the appropriate reports in the current licensing basis that EPRI has submitted to the NRC document control desk (i.e., to ADAMS) and that provide the current reactor pressure vessel surveillance data for the RBS reactor pressure vessel components.

The updated safety analysis report supplement for the Reactor Vessel Surveillance Program in LRA A.1.37 identifies that the version of the integrated surveillance program that will be implemented during the period of extended operation will be based on the methodology in EPRI Proprietary Report BWRVIP-86, Revision 1-A, which was approved by safety evaluation dated

October 20, 2011. However, the updated safety analysis report supplement for the AMP does not specify or define that the RBS-specific license renewal surveillance capsule that will be removed and tested during the period of extended operation in accordance the proprietary details in BWRVIP-86, Revision 1-A for removing, testing, and reporting the test results of the RBS ISP(E) capsule. This creates a regulatory issue for the staff because Section 5.3.1.6 of the updated safety analysis report currently states that removal of this this capsule can be indefinitely deferred. As a result these types of details may need to be included in the updated safety analysis report supplement summary description for the AMP.

**License Renewal Application AMP B.1.38, “RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants”**

Summary of Information in the Application. The LRA states that AMP B.1.38, “RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants,” is an existing program with enhancements that will be consistent with the program elements in GALL Report AMP XI.S7, “RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants.” To verify this claim of consistency, the staff audited the license renewal application AMP. During the audit, the staff reviewed the enhancements associated with this AMP. The staff will evaluate enhancements in the SER.

Audit Activities. During its audit, the NRC 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 following keywords: steel, concrete, crack, corrosion, loosening bolt, and spall.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
1. N/A	River Bend Station Nuclear Plant – B.1.38 RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants	
2. RBS-EP-15-00003	Entergy Nuclear Engineering Report: Operating Experience Review Results – Aging Management Program Effectiveness	Revision 2 / 6/20/17
3. RBS-EP-15-00008	RBS License Renewal Project - Aging Management Program Evaluation Results – Civil / Structural	Revision 1 / 4/03/17
4. EN-DC-150	Entergy Nuclear Management Manual – Condition Monitoring of Maintenance Rule Structures	Revision 9
5. STP-000-3602	River Bend Station Operating Manual – Surveillance Test Procedure – Fire Barrier Visual Inspection	Revision 15 / 8/27/14
6. EN-DC-141	Entergy Nuclear Management Manual - Design Input	Revision 15
7. EN-LI-102	Entergy Nuclear Management Manual – Corrective Action Process	Revision 24
8. RBS-CS-00002	Aging management Review of the WCS	5/31/16
9. CR-RBS-2016-04092	Hairline Cracking on Exterior Concrete Wall	5/31/16
10. CR-RBS-2014-00516	General steel corrosion on supplementary steel support	2/04/14

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 license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit of the “operating experience” program element, the staff’s independent database search did not identify any operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

**License Renewal Application AMP B.1.39, “Selective Leaching”**

Summary of Information in the Application. The LRA states that AMP B.1.39, “Selective Leaching,” is a new program that will be consistent with the program elements in GALL Report AMP XI.M33, “Selective Leaching,” as modified by LR-ISG-2011-03, “Changes to the Generic Lessons Learned (GALL) Report Revision 2 Aging Management Program XI.M41, ‘Buried and Underground Piping and Tanks,’” and LR-ISG-2015-01, “Changes to Buried and Underground Piping and Tank Recommendations.” To verify this claim of consistency, the staff audited the license renewal application AMP. At the time of the audit, the applicant had not yet fully developed the documents necessary to implement this new program, and the staff’s audit addressed only the program elements described in the applicant’s basis document and a search of plant-specific operating experience. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
RBS-EP-15-00007	Aging Management Program Evaluation Results Non Class 1 Mechanical, Selective Leaching	Revision 0
RBS-EP-15-00003	Operating Experience Review Results – Aging Management Program Effectiveness, Section 3.2.11, “Selective Leaching”	Revision 1
EC-RBS-18693	Update LDT [Line Designation Table] for Location of Buried Piping	Revision 0

During the audit, the staff verified that the “preventive actions,” “parameters monitored or inspected,” “monitoring and trending,” and “acceptance criteria” program elements of the license renewal application 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 whether they were consistent with the corresponding program elements of the GALL Report AMP. In order to verify whether 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” element of the license renewal application AMP states that the program includes components exposed to an environment of raw water, treated water, or soil. However, the staff noted during its review that, for components exposed to waste water, the applicant will use the Selective Leaching program to manage for loss of material due to selective leaching.
- The “detection of aging effects” program element of the license renewal application AMP states, “[f]or buried components with coatings, no selective leaching inspections are necessary where coating degradation has not been identified.” The GALL Report AMP recommends that “[n]o selective leaching inspections are required of the external surface of buried components which are coated in accordance with Table XI.M41-1 of AMP XI.M41, and where visual examinations of in-scope buried piping has not revealed any coating damage”. It is not clear to the staff that these statements are consistent because during the staff’s review of EC-RBS-18693, the staff could not determine whether the external surfaces of in-scope buried gray cast iron components in the fire protection – water system are coated in accordance with Table XI.M41-1 of AMP XI.M41.

During the audit, the staff observed:

- The staff reviewed EC-RBS-18693 and noted that Attachment 9.4, “Buried Piping and Tanks Inspection and Monitoring Program,” states that portions of the external surfaces of fire protection–water piping are not coated.

During the audit of the “operating experience” program element, the staff’s independent database search did not identify any operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

#### **License Renewal Application AMP B.1.40, “Service Water Integrity”**

Summary of Information in the Application. The LRA states that AMP B.1.40, “Service Water Integrity,” is an existing program that is consistent with the program elements in GALL Report AMP XI.M20, “Open-Cycle Cooling Water System,” as modified by LR-ISG-2012-02, “Aging Management of Internal Surfaces, Fire Water Systems, Atmospheric Storage Tanks, and Corrosion under Insulation.” To verify this claim of consistency, the staff audited the license renewal application AMP. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. In addition, the staff walked down portions of the normal service water and standby service water systems. The staff conducted an independent search of the applicant’s operating experience database using the following keywords: 89-13, biological, coat, corros, leak, loss of material, piping, and redu.

The table below lists the documents that the staff reviewed and found to be relevant during the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
RBS-EP-15-00003	Operating Experience Review Results, Aging Management Program Effectiveness, Section 3.1.29, "Service Water Integrity Program"	Rev 1
RBS-EP-15-00007	Aging Management Program Evaluation Results Non-Class 1 Mechanical, Section 4.11, "Service Water Integrity"	Rev 0
EN-DC-184	NRC Generic Letter (GL) 89-13 Service Water Integrity	Rev 7
EN-DC-316	Heat Exchanger Performance and Condition Monitoring	Rev 7
SEP-SW-RBS-001	RBS GL 89-13 Service Water Heat Exchanger Program	Rev 0
SEP-HX-RBS-001	Service Water Heat Exchanger Inspections	Rev 1
SEP-HX-RBS-002	Performance Monitoring Program for Residual Heat Removal Heat Exchangers Div II	Rev 6
SEP-HX-RBS-003	Performance Monitoring Program for Residual Heat Removal Heat Exchangers Div I	Rev 2
SDC-118, 130 & 256	Service Water Design Criteria System Nos. 118, 130, & 256	Rev 5
RBS-EP-11-00004	Summary Report Cycle 16 and RF16 Heat Exchanger Insp	11/01/2011
RBS-EP-17-00001	Summary Report Cycle 17 and RF17 Heat Exchanger Insp	01/26/2017
RBS-EP-15-00019	Summary Report Cycle 18 and RF18 Heat Exchanger Insp	12/16/2015
RBG-44655	Updated Response to Generic Letter 89-13	10/21/1998
RBG-37425	Revision to Gulf States Utilities Company's Response to Generic Letter 89-13	09/01/1992
RBG-34558	Update to Gulf States Utilities Company's Response to Generic Letter 89-13	03/01/1991
RBG-34252	Gulf States Utilities Company's Follow-Up Response to Generic Letter 89-13	12/31/1990
RBG-32249	Gulf States Utilities Company's Initial Response to Generic Letter 89-13	02/02/1990
CR-RBS-2006-03376	Approximately 30 percent of the fill material has fallen out of the service water cooling cell D and into the service water cooling basin.	08/22/2006
CR-RBS-2008-05043	System 103 (Circulating Water) Collector pots were filled with broken pieces of cooling tower fill material.	08/22/2008
CR-RBS-2009-04345	Inspection of the standby service water cooling tower (SWP-TWR1) for Div 2 was performed on 9/23/2009. The overall condition was found to be very good. No structural, mechanical or otherwise functional defect were found. However, areas require further action.	09/24/2009
CR-RBS-2009-04830	Inspection of the standby service water cooling tower (SWP-TWR1) for Div 1 was performed on 9/30/2009. Inspected areas above and below the fans, and area above the fill including spray header and associated piping and hardware. The overall condition of the Div 1 side of the tower was found to be very good. No structural, mechanical or otherwise functional defects that could have a negative impact on the operability of the tower were found. However, areas require further action.	10/01/2009
CR-RBS-2010-06697	Inaccessible standby service water piping has not been regularly inspected. Portions of the return/riser piping are submerged in the standby cooling tower basin, which significantly increases susceptibility to outside diameter corrosion. Being inaccessible, the GL 89-13 recommendation (Item III) was not recognized as being applicable to this piping.	12/20/2010
CR-RBS-2011-07654	Non-conservative methodology for standby cooling tower performance and evaporation losses without drywell unit coolers.	10/28/2017

Document	Title	Revision / Date
CR-RBS-2012-06609	Coating inspection of submerged standby cooling tower piping performed. Minor coating degradation and light rust on some of the inspected piping due to aging. Need to repair or replace the coating to ensure the long term integrity of the piping.	10/22/2012
CR-RBS-2015-01252	Ultrasonic testing (UT) exam on pipe service water system (SWP)-030-028-3 to support installation of 30-inch valves for the Fukushima Project. UT shows 2 places below min wall of 0.164 inch that will require buttering for fit up purposes. (Ref P&ID-09-10E (M 7))	02/25/2015
CR-RBS-2017-02777	Water was observed falling from one location of the tile fill on the east air inlet of the standby cooling tower. Water falling from the tile fill indicates leak by from either the SWP-MOV55A or B valve seats.	03/23/2017

During the audit, the staff verified that the “monitoring and trending,” and “acceptance criteria” program elements of the license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP. However, the staff found that for the “scope of program,” “preventive actions,” “parameters monitored or inspected” and “detection of aging effects,” program elements, sufficient information was not available to determine whether they were consistent with the corresponding program elements of the GALL Report AMP. In order to verify whether 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.

- For the “scope of program” program element, RBS-EP-15-00007 states that there is no piping in the scope of its response to Generic Letter (GL) 89-13, “Service Water System Problems Affecting Safety-Related Equipment.” Therefore, no piping is in the scope of the Service Water Integrity program. However, RBS’ updated response to GL 89-13, dated December 31, 1990, for Action Item III states that the site has established a routine inspection and maintenance program to ensure that corrosion, erosion, protective coating failure, silting, and biofouling will not degrade the service water system. Although RBS provided additional responses to GL 89-13, these subsequent responses addressed Action Item II and did not address the previously provided activities for Action Item III. It is unclear to the staff that piping is not within the scope of the Service Water Integrity program based on the RBS responses to GL 89-13.
- For the “preventive actions” program element, RBS-EP-15-00007 states that corrosion products are insignificant due to the normal service water system water treatment; therefore, RBS did not identify periodic flushing as part of its response to GL 89-13. Periodic flushing is not performed under the Service Water Integrity program. However, RBS’ updated response to GL 89-13, dated December 31, 1990, for Action Item I, states that actions to verify flow in portions of the infrequently used cooling loops were completed. Although RBS provided additional responses to GL 89-13, these subsequent responses addressed Action Item II and did not address the previously provided activities for Action Item I. It is unclear to the staff whether periodic flushing or flow testing, as prescribed in GL 89-13 Action I to ensure infrequently used piping is not clogged, was identified as part of RBS’s response to GL 89-13.
- For the “preventive actions” program element, based on the operational activities for the vacuum release solenoid valves (SOVs 522A, B, C, and D and SOVs 523A, B, C, and D), there is an air-to-water interface within portions of the associated stagnant

pipng. Industry operating experience in NRC Information Notice 2013-06, "Corrosion in Fire Protection Piping Due to Air and Water Interaction," has shown that this can lead to increased corrosion due to differential aeration corrosion at the air-to-water interface and subsequent flow blockage. This causes the staff to question the effectiveness of the normal service water system water treatment. It is unclear to the staff whether periodic flushing or flow testing is needed to ensure that infrequently used piping is not clogged for these portions of the service water system with an air-to-water interface.

- For the "parameters monitored or inspected" program element, LRA Table 3.3.2-3, "Service Water System," lists nozzles with an intended function of only pressure boundary, an aging effect requiring management as only loss of material, and the aging management program as Internal Surfaces in Miscellaneous Piping and Ducting Components. The service water system design criteria states that the returning service water is sprayed and cooled in the standby service water cooling tower, indicating that the spray nozzles have an intended function of either flow control or flow distribution. It is unclear to the staff a) whether all intended functions of the spray nozzles have been identified, b) whether aging affects requiring management should also include flow blockage due to fouling for the raw water environment, and c) whether these components, which are part of the system that directly rejects heat to a heat sink, are within the scope of GL 89-13 and consequently within the scope of the Service Water Integrity program.
- For the "detection of aging effects" program element, RBS-EP-15-00007 states that the applicant periodically uses nondestructive testing to measure the extent of wall thinning associated with service water integrity components. Large portions of the distribution piping for the standby service water cooling tower have standing water with air-to-water interfaces that, based on industry operating experience in NRC Information Notice 2013-06, "Corrosion in Fire Protection Piping Due to Air and Water Interaction," present increased potential for corrosion and corrosion product accumulation. It is not clear to the staff whether augmented inspections should be considered to ensure loss of material and flow blockage due to fouling are being adequately managed.

During the audit of the "operating experience" program element, the staff's independent search of the applicant's operating experience database identified operating experience to indicate that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER. In light of the plant-specific operating experience, in order to determine whether the applicant's license renewal application AMP can be adequate to manage the associated aging effects, the staff will consider issuing an RAI for the subject discussed below.

- Condition report CR-RBS-2008-05043 documents broken pieces of cooling tower fill that the applicant indicated was the same as the standby service water cooling tower fill material. In addition, CR-RBS-2006-03376 describes an issue with the fill material in the cooling tower for the service water cooling system. Fouling caused a substantial increase in the weight of the fill material resulting in a structural failure of the fill supports. Corrective actions for this condition report included the development of a repetitive task to remove a representative sample of the fill for evaluation. However, LRA Table 3.5.2-2, "Water-Control Structures," lists the cooling tower tile fill for the standby service water and service water cooling towers as having no aging

effects requiring management with no aging management program. Based on the plant's operating experience, it is not clear to the staff that there are no aging effects requiring management for the cooling tower fill as provided in LRA Table 3.5.2-2.

The staff also audited the updated safety analysis report supplement's description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

#### **License Renewal Application AMP B.1.41, "Structures Monitoring"**

Summary of Information in the Application. The LRA states that AMP B.1.41, "Structures Monitoring," is an existing program with enhancements that will be consistent with the program elements in GALL Report AMP XI.S6, "Structures Monitoring." To verify this claim of consistency, the staff audited the license renewal application AMP. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER. During the audit, the staff reviewed the enhancements associated with this AMP. The enhancements are evaluated in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant's staff and reviewed onsite documentation that the applicant provided. The table below lists the documents that NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
RBS-EP-15-00008	Aging Management Program Evaluation Results (AMPER) – Civil / Structural	Revision 1
EN-DC-150	Condition Monitoring of Maintenance Rule Structures	Revision 9
EN-MA-145	Maintenance Standard for Torque Applications	Revision 8
SDRD-S02	Turbine Building, Structural Design Requirements Document	Revision 0
RBS-CS-13-00004	RF-17 Maintenance Rule Structures Periodic Assessment of Drywell, Standby Cooling Tower and Heater Bay Area	Revision 0
RBS-CS-05-00001	2005 Maintenance Rule Structures Periodic Assessment	Revision 0
RBS-CS-14-00001	2014 Maintenance Rule Structures Periodic Assessment	Revision 0
Spec 210.311	Specification for Fabrication of Category I Structural Steel, Miscellaneous Steel, and Embedment	Revision 1 01/06/1984
Spec 210.315	Specification for Structural Steel – Maintenance & Modification	Revision 0
Spec 210.330	Specification for Miscellaneous Steel and Embedment Category II and III	Revision 2 07/13/1982
GCAL 215082726	Analysis Results (Well Water Samples Report)	09/04/2015
CR-RBS-20058-00581	Structural Conditions Observed in the Turbine Building	01/19/2008
CR-RBS-2009-001005	Deficiencies Identified in the G Tunnel	02/20/2009
CR-RBS-2012-01939	Review of NRC IN 2011-20, Concrete Degradation by Alkali-Silica Reaction	03/16/2012
CR-RBS-2014-00516	General steel corrosion identified on supplementary steel support in Control Building	02/04/2014
CR-RBS-2014-01367	Grouting at the pedestal of the main plant stack supports	03/20/2014
CR-RBS-2009-06118	Turbine Building Foundation Crack Identified	11/30/2009
CR-RBS-2010-02033	Anchor Bolt not installed per specification requirements	05/05/2010
CR-RBS-2016-04092	Hairline Crack on the exterior concrete wall of the west and south walls of the main control room	05/31/2016
DWG ES-1H-4	General Notes and References	Revision 4
DWG ES-53A-9	Floor Plan El. 186'-3" Reactor Building	Revision 9

During the audit, the staff verified that the “scope of program,” “preventive actions,” “monitoring and trending,” and “acceptance criteria” program elements of the license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP, as applicable to RBS.

In addition, the staff found that for “parameters monitored or inspected,” and “detection of aging effects” program elements, sufficient information was not available to determine whether they were consistent with the corresponding program elements of the GALL Report AMP. In order to verify whether 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 “parameters monitored or inspected” and “detection of aging effects” program elements of the license renewal application AMP excludes the monitoring of stress corrosion cracking (SCC) in high-strength structural bolts, and the use of supplemented visual inspections. The GALL Report AMP recommends that high-strength (actual measured yield strength  $\geq 150$  ksi or 1,034 MPa) structural bolts greater than 1 inch (25 mm) in diameter be monitored for stress corrosion cracking, and that visual inspections be supplemented with volumetric or surface examinations to detect cracking. During the audit, the staff noted that Section 3.4.A of RBS-EP-15-00008, “AMPER – Civil / Structural,” stated that high-strength structural bolting is not considered susceptible to stress corrosion cracking since RBS does not use threaded lubricants containing molybdenum disulfide. It is not clear to the staff that these statements are consistent because the GALL Report does not credit the molybdenum disulfide thread lubricant as the only contributor to stress corrosion cracking in high-strength bolts. The staff also noted that structural specification allows the use of high-strength structural bolts greater than 1 inch in diameter at RBS.

During the audit, the staff observed:

- The staff reviewed EN-DC-150, “Condition Monitoring of Maintenance Rule Structures,” and confirmed that inspector qualifications are consistent with the ACI 349.3R recommendations.
- The staff reviewed Section 2.4.13 of the updated safety analysis report and Report No. GCAL 215082726 and verified that ground water sample analysis showed that groundwater remains nonaggressive.
- The staff reviewed Section 3.4.1.2 of the updated safety analysis report and RBS-EP-15-00008, “AMPER – Civil / Structural,” and confirmed that no dewatering system is relied upon to manage settlement and erosion of porous concrete subfoundations.
- The staff reviewed Specifications Nos. 210.330 and 210.311, and noted that RBS specifications allow the use of high-strength anchor bolts with diameters greater than 1 inch for some applications.

During the audit of the “operating experience” program element, the staff’s independent database search did not identify any operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER.

The staff also audited the updated safety analysis report supplement’s description of the LRA aging management program. The staff verified this description is consistent with the description provided in the SRP-LR.

**License Renewal Application AMP B.1.42, “Water Chemistry Control—BWR”**

Summary of Information in the Application. The LRA states that AMP B.1.42, “Water Chemistry Control—BWR,” 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 license renewal application AMP. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC 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 following keywords: oxygen, hydrogen water chemistry, dissolved oxygen, and cracking.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
CSP-0006	Reactor Coolant Water Surveillance	Revision 39
N/A	RBS Strategic Chemistry Plan	Revision 10

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 license renewal application AMP are consistent with the corresponding elements of the GALL Report AMP.

During the audit, the staff observed:

- The staff reviewed CSP-0006 and noted the RBS currently uses On-line Noble Chemistry in conjunction with the Hydrogen Water Chemistry.

During the audit of the “operating experience” program element, the staff’s independent database search did not identify operating experience that would indicate that the AMP may not be adequate to manage the associated aging effects. The staff will evaluate the identified plant-specific operating experience in the SER.

The staff also audited the updated safety analysis report supplement’s description of the license renewal application AMP. The staff verified that the updated safety analysis report supplement description is consistent with the SRP-LR description.



**Staff Review of Aging Management Review Items Associated with Boraflex Monitoring**

Summary of Information in the Application. During the audit, the staff reviewed plant documentation associated with the following:

- LRA Table 3.3.2-15, “Fuel Pool Cooling and Cleanup System,” which cites Boron carbide/elastomer exposed to treated water (external) will be managed for change in material properties
- LRA Table 3.3.2-15, “Fuel Pool Cooling and Cleanup System,” which cites Boron carbide/elastomer exposed to treated water (external) will be managed for reduction in neutron absorption capacity

The table below lists the document that the NRC staff reviewed and found relevant to the above items. The applicant provided the document.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
CR-RBS-2012-02995	Racklife Boron Loss Assumption Exceeded	05/02/2012

During the audit, the staff observed:

- The staff reviewed CR-RBS-2012-02995 and noted that the licensee intends to remove credit for Boraflex and install neutron absorber inserts to maintain the subcriticality margin in the SFP prior to the period of extended operation.

This staff will use this input in SER Section 3.0.3.2.02.

**Staff Review of Aging Management Review Items Associated with Containment Leak Rate**

Summary of Information in the Application. During the audit, the staff reviewed plant documentation associated with the following:

- LRA Table 3.5.2-1 “Reactor Building-Summary of Aging Management Evaluation” cites:
  - carbon steel/stainless steel elements (accessible areas): liner; liner anchors; integral attachments (steel containment vessel, floor, and suppression pool outer wall liner) exposed to indoor air (uncontrolled) for loss-of-material aging effect requiring management
  - stainless steel elements (accessible areas): liner; liner anchors; integral attachments (steel containment vessel, floor, and suppression pool outer wall liner) exposed to fluid environment (temperature < 140°F) for loss-of-material aging effect requiring management
  - carbon steel elements (inaccessible areas): liner; liner anchors; integral attachments (steel containment vessel floor and suppression pool outer wall liner) exposed to indoor air (uncontrolled) for loss-of-material aging effect requiring management

The table below lists the documents that NRC staff reviewed and found relevant to the review of the above carbon and stainless steel components. The applicant provided aspects of these documents.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
RL0-2014-0002 CA-32	RBS Assessment of NRC-IN-2014-07: Degradation of Leak-Chase Channel System for Floor Welds of Metal Containment Shell and Concrete Containment Metallic Liner	05/05/2014
OE-NOE-2016-00145-CA00011	RBS Assessment of NRC-RIS-2016-07: Containment Shell or Liner Moisture Barrier Inspection.	05/09/2016

During the audit, the staff observed:

- The staff reviewed assessments of IN-2014-07 and RIS-2016-07 included in RBS-EP-15-00003 and discussed these with the applicant during the audit. The staff confirmed that the leak chase channels are installed above the floor liner (i.e., not embedded in concrete below the liner) and are considered as containment primary pressure boundary/pressure retaining components. The staff also confirmed that consistent with ASME Code Section XI, Subsection IWE, the applicant visually inspects the leak chase channels exposed to air indoor environment at every inspection period during the containment inservice inspection interval (three times in 10 years). In addition, the staff confirmed that the applicant uses divers to visually inspect leak chase channels that are submerged (exposed to fluid environment [temperature < 140°F]) once in 10 years (IWE-2300 and Table IWE- 2500-1, Examination category E-A). There are no augmented examinations or moisture barriers.

The staff may use or reference this input in SER Section 3.0.3.2.15.

**Staff Review of Aging Management Review Items Associated with Inservice Inspection—IWF**

Summary of Information in the Application. During the audit, the staff reviewed plant documentation associated with the following:

- Table 3.5.2.-1, “Reactor Building Summary of Aging Management Evaluation,” cites carbon and stainless-steel supports/components exposed in air indoor/fluid environments for loss of material.
- Table 3.5.2-4, “Bulk Commodities - Summary of Aging Management Evaluation,” cites carbon steel, stainless steel, galvanized steel, aluminum supports/components in an air indoor/outdoor or fluid environments for loss of material/mechanical function/preload.

The table below lists the documents that NRC staff reviewed and found relevant to the review of these items. The applicant provided the documents below.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
RBS-CS-15-00004	Aging Management Review of Bulk Commodities	Revision 1
RBS-CS-15-00001	Aging Management Review of the Reactor Building	Revision 1

## Staff Review of Aging Management Review Items Associated with Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems

Summary of Information in the Application. During the audit, the staff reviewed plant documentation associated with the following:

- LRA Table 3.5.2-1, "Reactor Building-Summary of Aging Management Evaluation" and LRA Table 3.5.2-3, "Turbine Building, Auxiliary Building, and Yard Structures-Summary of Aging Management Evaluation," cite carbon steel cranes rails and structural girders exposed to indoor air (uncontrolled) for loss-of-material aging effect requiring management.

The table below lists the documents that NRC staff reviewed and found relevant to the review of these items. The applicant provided these documents to the NRC.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
EN-FAP-LR-006	Nuclear Management Manual - Fleet Admin Procedure, Structural Screening and AMRs	Revision 7
RBS-EP-15-00002	Operating Experience Review Results – Aging Effects Requiring Management (AERM)	Revision 1
RBS-EP-15-00003	Operating Experience Review Results – Aging Management Program Effectiveness	Revision 2
CR-RBS-2014-03166	Polar Crane: Missing structural bolt – Erroneous input	06/30/2014
CR-RBS-2015-00864	Turbine Building Overhead Crane Rails: Cracking of horizontal support beam	02/11/2015

During the audit, the staff observed:

The staff reviewed EN-FAP-LR-006 and noted that it provides RBS-specific notes for potential aging effects, including discussion on fretting or wear of hardware, appurtenances, and attachments.

The staff reviewed RBS-EP-15-00002 and noted that it documents the review process for operating experience aging-effect-requiring-management (AERM) reviews, including entries of condition reports (CRs) for crane-relevant aging management reviews.

The staff reviewed RBS-EP-15-00003 and noted that it documents the review process assessing program effectiveness (e.g., AMP reviews, program owners interviews, aging-effect-requiring-management operating experience reviews, ongoing operating experience reviews) to manage the relevant structural aging management reviews. Examples of operating experience reviews include:

- CR-RBS-2014-03166 (included also in Program Book and verified during independent operating experience audit) and noted that the condition report for the missing bolt was erroneous. A corrective action (CA) report indicated that a review of design drawings determined the vacant bolt hole was a drain hole.
- CR-RBS-2015-00864 (included also in Program Book and verified during independent operating experience audit) and noted that following a nondestructive examination (NDE) (mag particle) test it was determined that no cracks existed and concluded that the reported cracks were surface scratches or scuffs.

The staff may use this input in SER Section 3.0.3.2.10 and Section 3.3.2.1.1.

### Staff Review of Aging Management Review Items Associated with Protective Coating Monitoring and Maintenance

Summary of Information in the Application. During the audit, the staff reviewed plant documentation associated with the following:

- LRA Table 3.5.2-1, "Reactor Building," cites Service Level I coatings exposed to air (indoor) will be managed for loss-of-coating integrity.

The table below lists the document that NRC staff reviewed and found relevant to the review of these items. The applicant provided the document to the NRC.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
EN-DC-220	Safety-Related Coatings Program	Revision 3, 04/14/2016

During the audit, the staff observed:

- The staff reviewed EN-DC-220 and verified that the licensee's program procedures identify administrative controls and organizational responsibilities to manage loss-of-Service Level I coating integrity.

The staff will use this input in SER Section 3.0.3.1.23.

### Staff Review of Aging Management Review Items Associated with Structural Fatigue

Summary of Information in the Application. During the audit, the staff reviewed plant documentation associated with the following:

- LRA Table 3.5.1, "Structures and Component Supports," aging management review (AMR) item number 3.5.1-27 states, in part, that the current licensing basis (CLB) at RBS contains a fatigue analysis associated with the penetration sleeves; therefore, the aging effect of cracking due to cyclic loading is addressed under Aging Management Review Item 3.5.1-9 as a time-limited aging analysis (TLAA).

The table below lists the document that staff reviewed and found relevant to this item. The applicant provided this document to the NRC.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
RBS-EP-15-00005	TLAA-Mechanical Fatigue	Revision 0

During the audit, the staff observed:

- The staff reviewed RBS-EP-15-00005 and LRA Section 4.6 "Containment Liner Plate, Metal Containments, and Penetration Fatigue Analysis," and noted that these documents state that the applicant evaluated electrical penetrations sleeves and found stresses to be so low that a fatigue analysis was not required. For aging management of boiling-water reactor containment structures penetration sleeves, the GALL Report

recommends that if a current licensing basis fatigue analysis does not exist, cracking due to cyclic loading be managed by the GALL Report AMP XI.S1, "ASME Section XI, Subsection IWE," and GALL Report AMPXI.S4, "10 CFR Part 50, Appendix J." if a current licensing basis fatigue analysis exists, the GALL Report recommends the cumulative fatigue damage needs to be evaluated as a time-limited aging analysis in accordance with 10 CFR 54.21(c). Based on its review of the license renewal application, RBS-EP-15-00005, and the RBS updated safety analysis report, the staff found no evidence that a fatigue analysis for the electrical penetration sleeves is contained in RBS current licensing basis. Therefore, it is not clear how the applicant will manage the aging effects of cracking due to cyclic loading in electrical penetration sleeves consistent with the GALL Report recommendation if there is no current licensing basis fatigue analysis for the electrical penetrations. The staff will consider issuing an RAI on this subject.

The staff will use this input in SER Section 3.5.

### **Staff Review of Aging Management Review Items Associated with Crane Load Cycles Analysis**

Summary of Information in the Application. During the audit, the staff reviewed plant documentation associated with the following:

- LRA Table 3.5.2-1, "Reactor Building" cites carbon steel crane structural girders in an air-indoor uncontrolled environment for cracking.
- LRA Table 3.5.2-3, "Turbine Building, Auxiliary Building, and Yard Structures," cites carbon steel crane structural girders in an air-indoor uncontrolled environment for cumulative fatigue damage.

The table below lists the documents that NRC staff reviewed and found relevant to the review of these items. The applicant provided these documents to the NRC.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
<u>EN-FAP-LR-008</u>	TLAA and Exemptions Evaluations	Revision 4
EN-FAP-LR-006	Nuclear Management Manual - Fleet Admin Procedure, Structural Screening and AMRs	Revision 6
RBS-EP-15-00010	Aging Management Review Summary	Revision 1

During the audit, the staff observed:

- The staff reviewed EN-FAP-LR-006 and noted that it provides RBS-specific notes for cumulative fatigue damage that may exist regarding metal fatigue of the steel crane structural girders described above.
- The staff reviewed EN-FAP-LR-008 and noted that it discusses the process for identifying and evaluating time-limited aging analyses including aging management review time-limited aging analyses that apply to a structure or structural component.

This staff may use or reference this input in SER Section 3.3.2, 4.6 and Section 4.7.4.

**License Renewal Application TLA Section 4.2.1, “Reactor Vessel Fluence,” and LRA TLA Section 4.7.3, “Fluence Effects for Reactor Vessel Internals”**

Summary of Information in the Application. LRA Section 4.2.1, “Reactor Vessel Fluence,” discusses the neutron fluence methodology and projection analysis for the reactor pressure vessel (RPV) that are included in the plant design. Similarly, LRA Section 4.7.3, “Fluence Effects for Reactor Vessel Internals,” discusses the neutron fluence methodology and projection analysis for reactor vessel internal (RVI) components that are included in the plant design. The applicant dispositioned these time-limited aging analyses in accordance with 10 CFR 54.21(c)(1)(ii). The applicant stated it had projected the neutron fluence values for the components to the end of the period of extended operation.

To verify that the applicant provided a basis to support its disposition of the time-limited aging analyses, the staff audited the time-limited aging analyses. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff also performed an audit comparing two sources where the applicant described its neutron fluence methodologies for reactor pressure vessel and reactor vessel internals components. The two sources are (1) the current licensing basis and (2) the license renewal application, specifically LRA Section 4.2.1 (for reactor pressure vessel neutron fluence-dependent, time-limited aging analyses in LRA Chapter 4.2.2 – 4.2.6) and LRA Section 4.7.3 (for the reactor vessel internals components). The staff’s audit on neutron fluence methodology also included those fluence methodologies that Entergy submitted or referenced in the following: (1) most recent license amendment requests for the current pressure-temperature limits (P-T limit), (2) assessments in the current licensing basis for the reactor pressure vessel integrated surveillance program (ISP). Lastly, the staff’s audit on neutron fluence methodology included Entergy-submitted information that the NRC approved for the current 10 CFR 50.55a, “Codes and Standards,” code relief for reactor pressure vessel circumferential welds in the current licensing basis.

The table below lists the documents that NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
LRA, Section 4.2.1	Reactor Vessel Fluence Analysis	Revision 0
LRA, Section 4.2.2	Adjusted Reference Temperature Analyses <sup>1</sup>	Revision 0
LRA, Section 4.2.3	Pressure-Temperature Limits Analysis <sup>1,2</sup>	Revision 0
LRA, Section 4.2.4	Upper Shelf Energy Analyses <sup>1</sup>	Revision 0
LRA, Section 4.2.5	Reactor Vessel Circumferential Weld Inspection Relief Analysis <sup>3</sup>	Revision 0
LRA, Section 4.2.6	Reactor Pressure Vessel Axial Weld Failure Probability Analysis <sup>3</sup>	Revision 0
LRA, Section 4.2.7	Reactor Pressure Vessel Core Reflood Thermal Shock Analysis <sup>4</sup>	Revision 0

Document	Title	Revision / Date
LRA Section 4.7.3	Fluence Effects for Reactor Vessel Internals	Revision 0
Regulatory Guide 1.190	Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence	March 2001
USAR Section 4.1.4.5	Neutron Fluence Calculations	Revision 24
USAR Section 4.3.2.8	Vessel Irradiations	Revision 24
USAR Section 5.3.1.6.2	Neutron Flux and Fluence Calculations	Revision 24
USAR Section 5.3.1.6.3	Predicted Irradiation Effects on Vessel Beltline Materials	Revision 24
MPM Vendor Report No. MPM-904779	Neutron Transport Analysis for River Bend Station <sup>5</sup>	November 2004
RBS Report No. RBS-NE-17-00002	GEH 003N2078, Rev. 0, Entergy Operations, Inc., River Bend Nuclear Station Plant License Renewal Fluence Projection (Proprietary Report) <sup>6</sup>	March 2017
General Electric Company Report No. NEDC-32983P-A	General Electric Methodology for Reactor Pressure Vessel Fast Neutron Flux Evaluations (Proprietary Report) <sup>6</sup>	January 2006
RBS Report No. RBS-NE-17-00004	GEH 003N9941, Rev. 0, Entergy Operations, Inc., River Bend Nuclear Station Plant, Fluence Effect Evaluation on RPV Internal Components (Proprietary Report) <sup>7</sup>	March 2017
Entergy Letter Submitting License Amendment Request to Facility Operating License NPF-47	River Bend Station Licensing Amendment Request (LAR 2000-26), "Revision to reactor vessel pressure/temperature (PIT or P-T) limits", and application of ASME Code Case N640. (ADAMS ML010300130)	January 24, 2001
NRC Safety Evaluation Report and License Amendment No. 120 to Facility Operating License NPF-47	River Bend Station, Unit 1 – Issuance of Amendment RE: Revision to Reactor Vessel Pressure/Temperature (P-T) Limits (ADAMS ML012280403)	September 14, 2001
Entergy Letter No. RBG-45990 Submitting License Amendment Request to Facility Operating License NPF-47	License Amendment Request (LAR) 2002-23, "Request for a Change to the Reactor Vessel Material Surveillance Program" (ADAMS ML022320695)	August 15, 2002
NRC Safety Evaluation Report and License Amendment No. 136 to Facility Operating License NPF-47	River Bend Station, Unit 1 – Issuance of Amendment RE: Reactor Vessel Material Surveillance Program (ADAMS ML032050454)	July 24, 2003
Entergy Letter No. CNRO-2005-00036 Submitting ASME Code Section XI Relief Request	Request for Alternative to 10 CFR 50.55a Examination Requirements of Category B1.11 Reactor Pressure Vessel Welds (ADAMS ML052410293)	August 24, 2005
NRC Safety Evaluation Report and Relief Request from 10 CFR 50.55a Inservice Inspection Requirements	River Bend Station, Unit 1 – Relief Request RBS-ISI-004 for Alternative to Section 50.55a of Title 10 of the Code of Federal Regulations (10 CFR) for Examinations Requirements of Category B1.11 Reactor Pressure Vessel Welds (ADAMS ML061810463)	July 14, 2006
LRA Appendix A, Section A.2.1, Subsection A.2.1.1	Reactor Vessel Fluence	Revision 0
LRA Appendix A, Section A.2.5, Subsection A.2.5.3	Fluence Effects for Reactor Vessel Internals	Revision 0

Document	Title	Revision / Date
CR-RBS-2017-04807	Discrepancy found between SAR and TRM and BWRVIP ISP on capsule pull schedule.	June 19, 2017
CR-RBS-2017-06774	GEH identified an error in their neutron fluence model used to calculate license renewal fluence projections. These projections are used as inputs to PT curves and RPV internals.	September 18, 2017
RBS-EP-15-00004	TLAA and Exemption Evaluation Results	Revision 0
0221.110-000-109H	Core Support Structure Design Description (22A4052)	Revision 8

Document Reference Table Notes:

1. The regulation in 10 CFR Part 50, Appendix G, "Fracture Toughness Requirements," mandates the fluence-dependent analysis.
2. The current fluence-dependent P-T limit curves for 32 EPFY were approved in License Amendment No. 120 and are located in Technical Specification (TS) 3.4.11, Figure 3.4.11-1. The applicant is required to submit and receive approval of updated P-T limit curves for plant operations beyond 32 effective full-power years prior to the expiration of the current curves in the TS figure. Under the current licensing basis for the facility, the applicant must submit the updates of the P-T limit to the staff for approval as a 10 CFR 50.90, "Application for Amendment of License, Construction Permit, or Early Site Permit," license amendment request, or equivalent reporting requirements in 10 CFR 54.22, "Contents of Application--Technical Specifications," if updated P-T limit curves will be submitted as part of the processing of the LRA. However, Section 5.3.1.6.3 of the updated safety analysis report predicts that the current 32 effective full-power years P-T limit curves in the plant TS will expire prior to the end of the current operating period. Thus, it appears that the applicant will need to submit a fluence-dependent, P-T limits-related license amendment request under 10 CFR 50.90 in order to support current plant operations beyond 32 effective full-power years.
3. The analysis is included in the current licensing basis in support of the staff's current 10 CFR 50.55a(z) relief request approval of the alternative inservice inspection (ISI) requirements for the reactor pressure vessel circumferential shell welds. The analyses involve EPRI Report No. BWRVIP-05-defined probability of failure and fluence-dependent mean  $RT_{NDT}$  analyses for the weld types.
4. This analysis is not mandated by any NRC requirements, but was performed by the General Electric Company (GE, now GE-Hitachi, Inc.) for the licensee as part of the current design basis for the facility. The GE analysis is described and discussed in Section 5.3 of the updated safety analysis report. Like the other reactor pressure vessel neutron fluence time-limited aging analyses in LRA Chapter 4.2, this analysis is fluence-dependent.
5. Current reactor pressure vessel neutron fluence transport methodology referenced in Section 5.3 and Table 5.3-2 of the updated safety analysis report for the current licensing basis.
6. These neutron transport or flux methodologies are referenced in LRA Section 4.2.1 as the basis for the neutron fluence-dependent, time-limited aging analyses in LRA Chapter 4.2. These methodologies are not currently referenced in the updated safety analysis report as part of the current licensing basis.
7. This fluence methodology is referenced in LRA Section 4.7.3 as the basis for the plant-specific, fluence-dependent time-limited aging analysis for the reactor vessel internals components, as defined and evaluated in the LRA section. This methodology is not currently referenced in the updated safety analysis report as part of the current licensing basis.

During the audit of the time-limited aging analyses, the staff verified that the applicant has provided its basis to support its disposition of the time-limited aging analyses on neutron fluence for reactor pressure vessel and reactor vessel internals components using the staff's time-limited aging analysis acceptance criterion defined in 10 CFR 54.21(c)(1)(ii). During the audit, the staff identified potential neutron fluence methodology issues that may indicate that the current basis for accepting these time-limited aging analyses under the acceptance criterion in



10 CFR 54.21(c)(1)(ii) may not be acceptable. In addition, the staff found insufficient information to support its review of the applicant's basis that supports its time-limited aging analysis disposition. The staff will evaluate the identified issues in the SER. However, in order to obtain information to review the acceptability of the applicant's basis for dispositioning these time-limited aging analyses in accordance with 10 CFR 54.21(c)(1)(ii), the staff will consider issuing RAIs for the subjects discussed below.

- In LRA Section 4.2.1, "Reactor Vessel Fluence," the applicant stated that the limiting reactor pressure vessel neutron fluence for the inside surface (ID) location of the reactor pressure vessel is projected to be  $8.35 \times 10^{18}$  n/cm<sup>2</sup> (E > 1.0 MeV) at the end of the proposed period of extended operation (i.e., at 54 effective full-power years (EFPY) or the end of the proposed 60-year plant licensing period). In contrast, Section 5.3.1.6.3 of the updated safety analysis report (Audit Ref. 12) indicates that the limiting reactor pressure vessel neutron fluence for the inside surface (ID) location of the reactor pressure vessel is projected to be  $8.96 \times 10^{18}$  n/cm<sup>2</sup> (E > 1.0 MeV) at the end of the current 40-year licensed plant life (i.e., at 36 effective full-power years). It is not clear to the staff that the acceptance criterion of 10 CFR 54.21(c)(1)(ii) is met for the following reason: it is not clear how the limiting neutron fluence for the reactor pressure vessel at 60-years could be lower than that projected for the vessel at 36 effective full-power years, given that the reactor will be operating for additional 18 effective full-power years during the period of extended operation.
- In LRA Section 4.2.1, the applicant stated that it determined the neutron fluence values for the reactor pressure vessel beltline and extended beltline welds, shells and nozzle components using the General Electric-Hitachi (GEH) method for neutron flux calculation documented in GEH Report No. NEDC-32983P-A. In the same LRA section, the applicant also states that the NRC approved the General Electric-Hitachi methodology. It is not yet clear to the staff whether the applicant adequately demonstrated that the time-limited aging analysis on reactor pressure vessel fluence is dispositioned in accordance with the acceptance criterion of 10 CFR 54.21(c)(1)(ii). The staff notes that the applicant has yet to demonstrate that it has appropriately qualified this neutron fluence methodology for application to both the reactor pressure vessel beltline components and reactor pressure vessel extended beltline components at RBS.
- In LRA Section 4.7.3, "Fluence Effects for Reactor Vessel Internals," the applicant stated that it had analyzed the effects of fluence on the integrity of the reactor vessel internals components at 60 years of operation (54 effective full-power years) for those reactor vessel internals components included in the applicable design specification. It is not yet evident to the staff whether the applicant adequately demonstrated that the time-limited aging analysis on reactor vessel internals fluence is dispositioned in accordance with the acceptance criterion of 10 CFR 54.21(c)(1)(ii). The staff notes that the applicant has yet to demonstrate that this neutron fluence methodology used for the reactor vessel internals components in LRA Section 4.7.3 (i.e., GEH Report 003N9941, Rev. 0) has been appropriately qualified for application to the reactor vessel internals components at the plant.
- LRA Section 4.7.3 does not provide the component-specific fluence value acceptance criterion used for the reactor vessel internals components analyzed in the time-limited aging analysis or the reactor vessel internals component-specific neutron fluence projections for 54 effective full-power years. Without this information, the staff cannot

validate the applicant's basis for dispositioning the time-limited aging analysis on reactor vessel internals fluence in accordance with the time-limited aging analysis acceptance criterion in 10 CFR 54.21(c)(1)(ii).

The staff also audited the descriptions of the time-limited aging analyses provided in the updated safety analysis report supplement: LRA Appendix A, Subsection A.2.1.1, "Reactor Vessel Fluence," and LRA Appendix A, Subsection A.2.5.3, "Fluence Effects for Reactor Vessel Internals." For LRA Appendix A, Subsection A.2.5.3, the staff verified that the description is consistent with the description provided in the SRP-LR. For LRA Appendix A, Subsection A.2.1.1, the staff found insufficient information to determine whether the description in the updated safety analysis report supplement was an adequate description of the LRA time-limited aging analysis. In order to verify the sufficiency of the updated safety analysis report supplement time-limited aging analysis description, the staff will consider issuing RAIs for the subject discussed below.

- The updated safety analysis report supplement for the reactor pressure vessel fluence time-limited aging analysis in LRA Appendix A, Subsection A.2.1.1 indicates that the neutron flux and transport methodology in GEH Proprietary Report No. NEDC-32983P-A (Audit Ref. 15) has been used as the basis for projecting the reactor pressure vessel component neutron fluence values to the end of the period of extended operation (i.e., to 54 effective full-power years). However, the staff's audit of this time-limited aging analysis noted that some condition reports may indicate that this GEH methodology may involve some errors. In addition, the updated safety analysis report supplement reports peak reactor pressure vessel, inside surface neutron fluence values at 54 effective full-power years that are lower than the corresponding values reported in Section 5.3 of the updated safety analysis report for the reactor pressure vessel at 36 effective full-power years. Thus, it is not currently evident to the staff that the updated safety analysis report supplement for this time-limited aging analysis provides an acceptable updated safety analysis report supplement summary description of the time-limited aging analysis. The applicant may need to provide additional information to demonstrate that the methodology for projecting neutron fluence values in the referenced GEH report is applicable to both reactor pressure vessel beltline and extended beltline components and is adherent with the staff's positions for implementing neutron fluence methodologies, as given and discussed in RG 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence."

#### **License Renewal Application Section 4.2.2, "Adjusted Reference Temperature TLAA"**

Summary of Information in the Application. LRA Section 4.2.2, "Adjusted Reference Temperature," discusses the change in the initial reference nil-ductility transition temperature due to increasing neutron irradiation. Although the time-limited aging analysis for adjusted reference temperature (ART) has been projected to the end of the period of extended operation in accordance with 10 CFR 54.21(c)(1)(ii), the applicant will formally complete the time-limited aging analysis as part of the established process for updating the reactor's pressure-temperature (P-T) limits to include new P-T limits that will be applicable and implemented during the period of extended operation.

To verify that the applicant provided a basis to support its disposition of the time-limited aging analysis, the staff audited the time-limited aging analysis. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

**Audit Activities.** During its audit, the NRC 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 following keywords: capsule, neutron, flux, surveillance, fluence, and embrittle. The staff also performed a search of the applicant’s audit portal for documents that are relevant to the staff’s audit review of the time-limited aging analysis.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
(Arial 9 point, left justified)		
RBS-NE-17-00002	Fluence Projection Report, GEH 003N2708	Revision 0
RBS-NE-17-00003	Pressure-Temperature Limits Report, GEH-003N8442	Revision 0
EC-0000024249	Update to the Adjusted RT <sub>NDT</sub> (ART) Values for RBS Reactor Vessel	Revision 1

During the audit of the time-limited aging analysis, the staff verified that the applicant has provided its basis that supports its disposition of 10 CFR 54.21(c)(1)(ii).

In addition, the staff found insufficient information to supports its review of the applicant’s basis that supports its time-limited aging analysis disposition. Specifically, during the audit, the staff’s independent database search identified potential issues that may impact the applicant’s basis for dispositioning the time-limited aging analysis in accordance with the requirement in 10 CFR 54.21(c)(1)(ii). In light of this information, and in order to determine whether the applicant’s time-limited aging analysis can be adequate to manage the associated aging effects, the staff will consider issuing RAIs for the subject discussed below.

- The staff reviewed CR-RBS-2017-06674 and noted that the reported neutron fluence values projected to 54 effective full-power years for the reactor pressure vessel beltline and extended beltline components may not be conservative. Therefore, LRA Table 4.2-2 may not report accurate neutron fluence and adjusted reference temperature values for the reactor pressure vessel beltline and extended beltline components at 54 effective full-power years. This may impact the validity of the reported adjusted reference temperature value for the limiting reactor pressure vessel beltline or extended beltline component at 54 effective full-power years.

The staff also audited the updated safety analysis report supplement’s description of the license renewal application AMP. The staff verified that the updated safety analysis report supplement description is consistent with the SRP-LR description.

**License Renewal Application TLA Section 4.2.3, “Pressure-Temperature Limits”**

Summary of Information in the Application. LRA Section 4.2.3, “Pressure-Temperature Limits,” discusses the time-limited aging analysis for pressure-temperature (P-T) limit evaluations. The applicant dispositioned the time-limited aging analysis in accordance with 10 CFR 54.21(c)(1)(iii).

To verify that the applicant provided a basis to support its disposition of the time-limited aging analysis, the staff audited the time-limited aging analysis. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC 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 following keywords: neutron, flux, surveillance, fluence, and embrittle.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant's operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
(Arial 9 point, left justified)		
RBS-NE-17-00002	Fluence Projection Report, GEH 003N2708	Revision 0
RBS-NE-17-00003	Pressure-Temperature Limits Report, GEH-003N8442	Revision 0
STP-050-0700	RCS Pressure/Temperature Limits Verification	06/06/2012
7221.100-000-002	PT Curve Update for Water Level Instrumentation Nozzle	Revision 0 04/22/2010
EC-RBS-0000022912	PT Curves – Addition of Water Level Instrumentation Nozzle	Revision 0 05/03/2011

During the audit of the time-limited aging analysis, the staff verified that the applicant has provided its basis that supports its disposition of 10 CFR 54.21(c)(1)(iii).

In addition, the staff found insufficient information to supports its review of the applicant's basis that supports its time-limited aging analysis disposition.

Specifically, during the audit, the staff's independent database search identified potential issues that may impact the applicant's basis for dispositioning the time-limited aging analysis in accordance with the requirement in 10 CFR 54.21(c)(1)(iii). In light of this information, and in order to determine whether the applicant's time-limited aging analysis can be adequate to manage the associated aging effects, the staff will consider issuing RAIs for the subject discussed below.

- The time-limited aging analysis credits the Reactor Vessel Material Surveillance Program in accordance with 10 CFR 54.21(c)(1)(iii). However, the AMP does not include any programmatic activities to monitor plant operations in a manner that would permit the applicant to correlate actual plant effective full-power year levels against the current P-T limits contained in the current technical specifications.
- The staff reviewed CR-RBS-2017-06674 and noted that the license renewal neutron fluence projected values may be inaccurate. This would mean LRA Table 4.2-2 and Table 4.2-3 do not contain the accurate fluence values and adjusted reference temperature for 54 effective full-power years. The applicant should evaluate any impact

to its LRA Section 4.2 time-limited aging analyses that would result in any change to its projected fluence values.

- The reviewed documents on the portal that included P-T limit curves that are more conservative than the approved curves. The staff is unclear on how the applicant is using these unapproved P-T limit curves.

The staff also audited the updated safety analysis report supplement's description of the license renewal application AMP. The staff verified that the updated safety analysis report supplement description is consistent with the SRP-LR description.

#### **License Renewal Application TLA Section 4.2.4, "Upper Shelf Energy"**

Summary of Information in the Application. LRA Section 4.2.4, "Upper Shelf Energy," discusses the analyses for the upper shelf energy (USE). The applicant dispositioned the time-limited aging analysis in accordance with 10 CFR 54.21(c)(1)(ii).

To verify that the applicant provided a basis to support its disposition of the time-limited aging analysis, the staff audited the time-limited aging analysis. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC 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 following keywords: capsule, neutron, flux, surveillance, fluence, and embrittle. The staff also performed a search of the applicant's audit portal for documents that are relevant to the staff's audit review of the time-limited aging analysis.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant's operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
(Arial 9 point, left justified)		
RBS-NE-17-00002	Fluence Projection Report, GEH 003N2708	Revision 0
RBS-NE-17-00003	Pressure-Temperature Limits Report, GEH-003N8442	Revision 0
EC-0000024249	Update to the Adjusted RT <sub>NDT</sub> (ART) Values for RBS Reactor Vessel	Revision 1

During the audit of the time-limited aging analysis, the staff verified that the applicant has provided the basis that supports its disposition of 10 CFR 54.21(c)(1)(ii).

In addition, the staff found insufficient information to supports its review of the applicant's basis that supports its time-limited aging analysis disposition. Specifically, during the audit, the staff's independent database search identified potential issues that may impact the basis for dispositioning the time-limited aging analysis in accordance with the requirement in 10 CFR 54.21(c)(1)(ii). The staff will evaluate these potential issues in the SER. In light of this

information, and in order to determine whether the applicant's time-limited aging analysis can be adequate to manage the associated aging effects, the staff will consider issuing RAIs for the subject discussed below.

- The staff reviewed CR-RBS-2017-06674 and noted that the reported neutron fluence values projected to 54 effective full-power years may not be conservative. Therefore, LRA Table 4.2-3 may not report accurate neutron fluence and USE values for 54 effective full-power years, and this may impact the reported EMA-derived upper shelf energy values for the limiting reactor pressure vessel plate components at 54 effective full-power years.

The staff also audited the updated safety analysis report supplement's description of the license renewal application AMP. The staff verified that the updated safety analysis report supplement description is consistent with the SRP-LR description.

**License Renewal Application TLAA Section 4.2.5, "Reactor Vessel Circumferential Weld Inspection Relief," and TLAA Section 4.2.6, "Reactor Vessel Axial Weld Failure Probability"**

LRA Section 4.2.5, "Reactor Vessel Circumferential Weld Relief," and LRA Section 4.2.6, "Reactor Vessel Axial Failure Probability," discuss the applicant's time-dependent, fluence-based probabilistic fracture mechanics (probability of failure) and mean  $RT_{NDT}$  analyses for the reactor pressure vessel (RPV) circumferential and axial welds. Reference 8 of the tabulated document list below provides methods for performing these types of analyses. Reference 9 of the tabulated document list below shows the approval for these methods. These time-limited aging analyses are based on the current licensing basis (CLB) analyses that were performed to support the 10 CFR 50.55a, "Codes and Standards," relief request for the reactor pressure vessel circumferential welds in the plant design. In a safety evaluation dated July 14, 2006 (ML061810463), the NRC granted the applicant relief request for the circumferential welds in the current licensing basis. The NRC permitted the applicant to withhold performance of the 10 CFR 50.55a(g) and ASME Section XI-required inspections of the reactor pressure vessel circumferential welds during the current operating term for the facility.

The applicant dispositioned the time-limited aging analysis for the reactor vessel circumferential weld inspection relief in accordance with 10 CFR 54.21(c)(1)(iii). In the disposition discussed in LRA Section 4.2.5, the applicant provided its evaluation to demonstrate the effects of cracking and loss-of-fracture toughness due to neutron irradiation embrittlement on the intended reactor coolant pressure boundary function of the reactor pressure vessel circumferential welds will be adequately managed during the period of extended operation. With respect to this time-limited aging analysis acceptance basis per 10 CFR 54.21(c)(1)(iii), if subsequent relief for the welds is desired for the 5<sup>th</sup> and 6<sup>th</sup> 10-Year ISI intervals during the period of extended operation, the applicant stated that it will use the implementation of the 10 CFR 50.55a(z), "Alternatives to Codes and Standards Requirements," relief request process to resubmit BWRVIP-05-based inservice inspection (ISI) relief requests for the reactor pressure vessel circumferential welds.

The applicant dispositioned the time-limited aging analysis for the reactor vessel failure probability in accordance with 10 CFR 54.21(c)(1)(ii). The applicant also provided an evaluation to demonstrate that it had projected the analysis to the end of the period of extended operation.

To verify that the applicant provided an adequate basis to support its disposition of the time-limited aging analyses, the staff audited these time-limited aging analyses. As part of this

audit, on October 26, 2017, the NRC held an audit breakout teleconference with the applicant on the topics related to these time-limited aging analyses. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant's staff and reviewed documentation that the applicant provided in the LRA's audit portal remote connection. The staff also performed an audit comparing the applicant's neutron fluence methodology as described by the applicant in two separate sources: (1) the current relief request approval in the current licensing basis and (2) LRA Section 4.2.1 (Audit Ref. 1) for these time-limited aging analyses. During the audit, the staff also performed independent calculations of the mean  $RT_{NDT}$  values for the reactor pressure vessel circumferential and axial welds in order to verify the accuracy of the mean  $RT_{NDT}$  values reported for these time-limited aging analyses in LRA Table 4.2-6 (for the circumferential welds) and LRA Table 4.2-7 (for the reactor pressure vessel axial welds).

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified the documents by searching the applicant's operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
1. LRA, Section 4.2.1	Reactor Vessel Fluence Analysis	Revision 0
2. LRA, Section 4.2.5	Reactor Vessel Circumferential Weld Inspection Relief Analysis <sup>3</sup>	Revision 0
3. LRA, Section 4.2.6	Reactor Pressure Vessel Axial Weld Failure Probability Analysis <sup>3</sup>	Revision 0
4. Entergy Letter No. CNRO-2005-00036 Submitting ASME Code Section XI Relief Request	Request for Alternative to 10 CFR 50.55a Examination Requirements of Category B1.11 Reactor Pressure Vessel Welds (ADAMS ML052410293)	August 24, 2005
5. NRC Safety Evaluation Report and Relief Request from 10 CFR 50.55a Inservice Inspection Requirements	River Bend Station, Unit 1 – Relief Request RBS-ISI-004 for Alternative to Section 50.55a of Title 10 of the Code of Federal Regulations (10 CFR) for Examinations Requirements of Category B1.11 Reactor Pressure Vessel Welds (ADAMS ML061810463)	July 14, 2006
6. LRA Appendix A, Section A.2.1, Subsection A.2.1.5	Reactor Vessel Circumferential Weld Inspection Relief	Revision 0
7. LRA Appendix A, Section A.2.1, Subsection A.2.1.6	Reactor Vessel Axial Weld Failure Probability	Revision 0
8. EPRI Topical Report No. TR-105697	BWRVIP-05, "BWR Vessel and Internals Project, BWR Reactor Pressure Vessel Shell Weld Inspection Recommendations"	September 1995
9. NRC Safety Evaluation	Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP- 05 Report (NRC Microfiche Accession No. 9806030081)	July 28, 1998
10. NRC Safety Evaluation	Supplement to Final Safety Evaluation of the BWR Vessel and Internals Project BWRVIP-05 Report (NRC ADAMS Accession No. ML031430372).	March 7, 2000

Document	Title	Revision / Date
11. U.S. Nuclear Regulatory Commission Generic Letter No. 98-05	Boiling Water Reactor Licensees Use of the BWRVIP-05 Report to Request Relief from Augmented Examination Requirements on Reactor Pressure Vessel Circumferential Shell Welds	Nov. 10, 1998

During the audit of the time-limited aging analyses, the staff verified that the applicant has provided an adequate basis that supports its disposition of the time-limited aging analyses using the acceptance criterion in 10 CFR 54.21(c)(1)(iii) for the reactor pressure vessel circumferential weld assessment and 10 CFR 54.21(c)(1)(ii) for the reactor pressure vessel axial weld assessment.

In addition, the staff found insufficient information to support its review of the applicant’s basis that supports the applicant’s 10 CFR 54.21(c)(1)(ii)-based disposition of the time-limited aging analysis for the reactor vessel axial weld failure probability. In order to obtain information to review the acceptability of the applicant’s basis that supports its time-limited aging analysis disposition, the staff will consider issuing RAIs for the subject discussed below.

- In the LRA, the applicant states that it has appropriately projected to the end of the period of extended operation the mean  $RT_{NDT}$  values for the reactor pressure vessel Shell #1, Shell #2, and Shell #3 axial welds (i.e., reactor pressure vessel axial welds in the lower, lower-intermediate shell, and upper-intermediate shells). The applicant further states that the mean  $RT_{NDT}$  values continue to meet the limiting mean  $RT_{NDT}$  value (i.e., an  $RT_{NDT}$  value of 114 °F) for the corresponding Mod 2 case study in the BWRVIP-05 report. The LRA also states that the applicant uses the methods in NRC Regulatory Guide (RG) 1.99, Revision 2, as the basis for calculating reactor pressure vessel component-specific  $RT_{NDT}$  values. These methods include those for calculating the mean  $RT_{NDT}$  values of the reactor pressure vessel axial welds assessed in LRA Section 4.2.6, with the applicant’s and staff’s understanding that the RG 1.99, Revision 2 methods for calculating the mean  $RT_{NDT}$  values would be modified by the methods in ERPI Report BRVIP-05 such that they would not include a margin term assessment as part of the mean  $RT_{NDT}$  calculations. Regulatory Position 2 in RG 1.99, Revision 2, “Radiation Embrittlement of Reactor Vessel Materials,” provides criteria for using reactor pressure vessel surveillance data to perform  $RT_{NDT}$  (including mean  $RT_{NDT}$ ) calculations when two or more sets of surveillance data become available for the heat of material used to fabricate a specific reactor pressure vessel component. The LRA indicates that the reactor pressure vessel Shell #2 axial welds are represented by enough surveillance data to perform the calculations of mean  $RT_{NDT}$  for weld using the “surveillance-ratio” method defined in Position 2.1 of RG 1.99, Revision 2. However, the staff noted that LRA Table 4.2-7 did not include a separate calculation of the mean  $RT_{NDT}$  value for the Shell #2 axial welds (i.e., reactor pressure vessel lower-intermediate shell axial welds) using the credible surveillance data and “surveillance-ratio” method addressed in RG 1.99, Revision 2, even though 4 sets of credible BWRVIP-integrated surveillance program surveillance data are available for the assessment of these axial weld components. This NRC staff identified the matter to the applicant during the audit breakout teleconference on this time-limited aging analysis (held October 26, 2017.)

The staff also audited the updated safety analysis report supplement’s description of these time-limited aging analysis ((provided in Sections A.2.1.5 and A.2.1.5 of the updated safety analysis report supplement of the LRA (i.e., LRA Appendix A)). The staff verified the updated



safety analysis report supplement summary descriptions for the time-limited aging analyses are consistent with the descriptions provided for these time-limited aging analyses in the SRP-LR.

### **License Renewal Application TLA Section 4.3.1, “Class 1 Fatigue,” and Related Aging Management Review Items**

Summary of Information in the Application. LRA Section 4.3.1, “Class 1 Fatigue,” discusses the applicant’s metal fatigue and cumulative usage factor analyses for ASME Code Class 1 reactor pressure vessel (RPV) components, reactor vessel internal (RVI) components, reactor recirculation pump (RRP) components, control rod drive (CRD) housing components, and piping or inline components that have been analyzed with ASME-defined cumulative usage factor analyses.

For the metal fatigue analyses that apply to the Class 1 reactor pressure vessel, reactor recirculation pump, control rod drive housing, or piping/inline components, the applicant dispositioned the time-limited aging analyses in accordance with 10 CFR 54.21(c)(1)(iii). The applicant credited the Fatigue Monitoring Program (LRA AMP B.1.18) as the basis for demonstrating that during the period of extended operation, the applicant will adequately manage impacts of cumulative fatigue damage or cracking due to fatigue on the intended functions of the components.

For the reactor vessel internals components that have been analyzed with a cumulative usage factor analysis, the applicant dispositioned the time-limited aging analyses in accordance with 10 CFR 54.21(c)(1)(iii). The applicant credited the BWR Vessel Internals Program (LRA AMP B.1.10) as the basis for demonstrating that it will adequately manage the impacts of cumulative fatigue damage or cracking due to fatigue on the intended functions of the components during the period of extended operation.

During the audit, the staff also reviewed plant documentation associated with the following:

- Table 2 aging management review (AMR) tables in LRA Section 3.1 for reactor coolant system (RCS) components as given in LRA Tables 3.1.2-1—3.1.2-3
- LRA Section 3.1.2.2.1, which provides the applicant’s aging management review further evaluation response to the further evaluation acceptance criteria in SRP-LR Section 3.1.2.2.1 for the metal fatigue time-limited aging analysis-related aging management review items in the LRA Table 2 aging management review tables listed above

Audit Activities. During its audit, the NRC 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 following keywords: fatigue, usage, cumulative usage factor, and CUF.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
LRA Section 4.3.1	Class 1 Fatigue	Revision 0
LRA USAR Supplement Section A.2.2.1	Class 1 Fatigue	Revision 0
LRA Section 3.1.2.2.1	Cumulative Fatigue Damage	Revision 0
LRA Table 2 AMR Tables in LRA 3.1, Reactor Coolant System, as listed in the bullets above	Table 2 AMR Tables in the RBS LRA for the Reactor Vessel, Reactor Internal, Class 1 Piping, and Non-safety Related RCS Components Impacting Safety-Related Component Intended Functions	Revision 0
RBS-EP-15-00005	RBS License Renewal Project, Mechanical Fatigue	Revision 0
Basic Technology Report No. BJ-75051	Stress Analysis Report on Double Volute (20x20x33 RV) Recirculation Coolant Pump	07/16/1976
RBS Design Document No. MR-96-0069	Feedwater Nozzle Safe-End Stress Report	06/10/1997
RBS Engineering Report No. RBS-EP-17-00006	Fatigue Update for River Bend Nuclear Station Using Fatigue-Pro Software	Revision 0, 11/21/2016
RBS Engineering Report No. RBS-EP-17-00005	Review of Past Cycle Counts for Accuracy	Revision 0, 11/10/2016

During the audit of the time-limited aging analysis, the staff reviewed applicant’s basis for the time-limited aging analysis disposition in accordance with 10 CFR 54.21(c)(1)(iii). Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

The staff found insufficient information to confirm that the applicant’s basis is sufficient to support the applicant’s time-limited aging analysis disposition. In order to obtain information to review the acceptability of the applicant’s basis that supports its time-limited aging analysis disposition, the staff will consider issuing one or more RAIs for the subjects discussed below.

- LRA Section 4.3.1.1 indicates that the cumulative usage factor analyses for the Class 1 reactor pressure vessel components are acceptable in accordance the time-limited aging analysis acceptance criterion in 10 CFR 54.21(c)(1)(iii). The LRA section also indicates that the applicant will use the Fatigue Monitoring Program (LRA AMP B.1.18) to manage the impacts of cumulative fatigue damage or cracking due to fatigue or cyclical loading on the intended functions of the components during the period of extended operation. SRP-LR Section 4.3.2.1.1.3 states that an AMP corresponding to GALL Report AMP X.M1, “Fatigue Monitoring,” may be used as the basis for accepting a cumulative usage factor analysis in accordance with 10 CFR 54.21(c)(1)(iii). Although the applicant’s approach is consistent with SRP-LR Section 4.3.2.1.1.3, the applicant did not

specifically identify which of the reactor pressure vessel components have been analyzed in the ASME Section III-defined cumulative usage factor analysis. Thus, it is not clear which of the components in the reactor pressure vessel are within the scope of the metal fatigue time-limited aging analysis for the Class 1 reactor pressure vessel components and the applicant's Fatigue Monitoring Program.

- LRA Section 4.3.1.2 indicates that the cumulative usage factor analyses for the Class 1 reactor vessel internals components are acceptable in accordance the time-limited aging analysis acceptance criterion in 10 CFR 54.21(c)(1)(iii). The LRA section also indicates that the applicant will use the BWR Vessel Internals Program (LRA AMP B.1.10) to manage the impacts of cumulative fatigue damage or cracking due to fatigue or cyclical loading during the period of extended operation. For time-limited aging analyses accepted under 10 CFR 54.21(c)(1)(iii), SRP-LR Section 4.7.2.1 states that the applicant must demonstrate that the time-limited aging analysis is acceptable in accordance with 10 CFR 54.21(c)(1)(iii). LRA Section 4.3.1.2 does not identify which of the specific reactor vessel internals components have been analyzed with a cumulative usage factor analysis. Without this information, the staff is unable to confirm that the applicant's BWR Vessel Internal Program is adequate to manage the aging effect due to fatigue for those reactor vessel internals components and to serve as an acceptable basis for the time-limited aging analysis disposition in accordance with 10 CFR 54.21(c)(1)(iii).
- LRA Section 4.3.1.3 indicates that the cumulative usage factor analyses for the Class 1 piping and inline components are acceptable in accordance the time-limited aging analysis acceptance criterion in 10 CFR 54.21(c)(1)(iii). The LRA section also indicates that the applicant will use the Fatigue Monitoring Program (LRA AMP B.1.18) to manage the impacts of cumulative fatigue damage or cracking due to fatigue or cyclical loading on the intended functions of the components during the period of extended operation. SRP-LR Section 4.3.2.1.1.3 states that an AMP corresponding to GALL Report AMP X.M1, "Fatigue Monitoring," may be used as the basis for accepting a cumulative usage factor analysis in accordance with 10 CFR 54.21(c)(1)(iii). Although the applicant's approach is consistent with SRP-LR Section 4.3.2.1.1.3, for plant piping systems identified in LRA Section 4.3.1.3, the applicant did not specifically identify which of the Class 1 components have been analyzed in accordance with an ASME Section III-defined cumulative usage factor analysis. Thus, it is not clear which of the Class 1 piping or inline components are within the scope of the metal fatigue time-limited aging analysis for the Class 1 piping and inline components and the applicant's Fatigue Monitoring Program.
- The updated cumulative usage factor analysis in RBS Engineering Report No. RBS-EP-17-00006 identifies that the applicant projects the cumulative usage factor value for one of the Class 1 piping components (i.e., the high pressure core spray line) to exceed the current licensing basis-defined cumulative usage factor allowable value for the component before the end of the 40-year current licensing term for the facility. The applicant's use of the Fatigue Monitoring Program to disposition the cumulative usage factor time-limited aging analysis for the component under 10 CFR 54.21(c)(1)(iii) may not be sufficient if the applicant does not take adequate action on this cumulative usage factor value nonconformance issue for the current licensing term. This issue is applicable to both the staff's review of LRA Section 4.3.1.5 and LRA updated safety analysis report supplement, Section A.2.2.1, "Class 1 Fatigue."

The staff also audited the updated safety analysis report supplement's description of the LRA's time-limited aging analysis on Class 1 Fatigue, as provided in LRA updated safety analysis report supplement, Section A.2.2.1. The staff found insufficient information to determine whether the description provided in the updated safety analysis report supplement was an adequate description of the time-limited aging analysis in LRA Section 4.3.1. In order to verify the sufficiency of the updated safety analysis report supplement program description, the staff will consider issuing an RAI for the subject that is discussed in the last bullet above.

### **License Renewal Application TLAA Section 4.3.2, Non-Class 1 Fatigue, and Related Aging Management Review Items**

Summary of Information in the Application. LRA Section 4.3.2, "Non-Class 1 Fatigue," discusses the metal fatigue analyses for non-Class 1 mechanical piping systems and components. LRA Section 4.3.2.1 and Section 4.3.2.2 address the following two categories of the time-limited aging analysis respectively: (a) piping and inline components in non-Class 1 piping systems or portions of piping designed to non-Class codes and requirements that have been evaluated with an expansion stress/maximum allowable stress range reduction analysis (i.e., implicit fatigue analysis) per the design code for the systems or components; and (b) non-Class 1, non-piping components that have been analyzed with a cumulative usage factor (CUF) analysis per the design code for the components. The applicant dispositioned the time-limited aging analyses in both of these non-Class 1 fatigue, time-limited aging analysis categories in accordance with 10 CFR 54.21(c)(1)(i). The applicant stated that it has demonstrated the time-limited aging analyses will remain valid through the end of the period of extended operation.

During the audit, the staff also reviewed plant documentation associated with the following:

- Table 2 aging management review (AMR) tables in LRA Section 3.1 for non-safety related reactor coolant system (RCS) components impacting the intended functions of safety related components, as given in LRA Table 3.1.2-4-1 and Table 3.1.2-4-2
- Table 2 aging management review (AMR) tables in LRA Section 3.2 for emergency safety feature (ESF) systems and components, as given in LRA Table 3.2.2-1—Table 3.2.2-7 and LRA Table 3.2.2-8-1—Table 3.2.2-8-5
- Table 2 aging management review tables in LRA Section 3.3 for auxiliary (AUX) systems and components, as given in LRA Table 3.3.2-1—Table 3.3.2-17 and LRA Table 3.3.2-18-1—Table 3.3.2-18-26
- Table 2 aging management review tables in LRA Section 3.4 for emergency steam and power conversion (SPC) systems and components, as given in LRA Table 3.4.2-1 and LRA Table 3.4.2-2-1—Table 3.4.2-2-4
- LRA Sections 3.2.2.2.1, 3.3.2.2.1, and 3.4.2.2.1, which provide the applicant's aging management review further evaluation responses to the further evaluation acceptance criteria in SRP-LR Sections 3.2.2.2.1, 3.3.2.2.1, and 3.4.2.2.1 for the metal fatigue time-limited aging analysis-related aging management review items in the LRA Table 2 aging management review tables listed above

**Audit Activities.** During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided. The staff did not conduct an independent search of the applicant’s operating experience database for this time-limited aging analysis because the applicant does not disposition these time-limited aging analyses in accordance with 10 CFR 54.21(c)(1)(iii), such that the applicant would need to credit an aging management program to manage fatigue-related aging effects in these non-class 1 components.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
LRA Section 4.3.2	Non-Class 1 Fatigue	Revision 0
LRA USAR Supplement Section A.2.2.2	Non-Class 1 Fatigue	Revision 0
LRA Sections 3.2.2.2.1, 3.3.2.2.1, and 3.4.2.2.1	Cumulative Fatigue Damage	Revision 0
LRA Table 2 AMR Tables in LRA Sections 3.1, 3.2, 3.3, and 3.4, as listed in the bullets above	Table 2 AMR Tables in the RBS LRA for Non-safety Related RCS Components and ESF, AUX, and SPC Systems That Are within the Scope of the LRA	Revision 0
RBS-EP-15-00005	RBS License Renewal Project, Mechanical Fatigue	Revision 0
EPRI Report No. 104534	EPRI Fatigue Management Handbook	Revision 0
EPRI Report No. 1010639	Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools	Revision 4

During the audit of the time-limited aging analysis, the staff verified that the applicant has provided an adequate basis that supports its disposition of the implicit fatigue time-limited aging analysis for non-Class 1 piping and inline components and the metal fatigue time-limited aging analysis for non-Class 1, non-piping components using 10 CFR 54.21(c)(1)(i). Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

However, staff found insufficient information in the relevant aging management review tables to support the adequacy of applicant’s basis for dispositioning these time-limited aging analyses in accordance with 10 CFR 54.21(c)(1)(i). In order to obtain information to review the acceptability of the applicant’s basis that supports its time-limited aging analysis disposition, the staff will consider issuing one or more RAIs for the subjects discussed below.

- Emergency safety feature systems and system components subject to a non-Class 1 fatigue analysis. The staff reviewed the applicable non-Class 1 fatigue time-limited aging

analyses for specific emergency safety feature systems or the associated components. The staff noted that the applicant may not have accounted for all emergency safety feature systems or components that need to be included in the scope of the non-Class 1 fatigue, time-limited aging analysis categories in LRA Sections 4.3.2.1 and 4.3.2.2. This issue applies to the following:

- a) emergency safety feature systems or components in Table 2 aging management review tables of LRA Section 3.2 that are included in the scope of a cumulative usage factor or implicit fatigue analysis as applicable design codes require, but are not appropriately identified in either LRA Section 4.3.2.1 or 4.3.2.2
  - b) emergency safety feature systems or components in Table 2 aging management review tables of LRA Section 3.2 that are included in the scope of either cumulative usage factor or implicit fatigue analysis and are appropriately identified in LRA Section 4.3.2.1 or 4.3.2.2, but are not appropriately identified in the relevant Table 2 aging management review tables for the metal fatigue time-limited aging analysis. Relevant Table 2 aging management review tables for the emergency safety feature systems are given in LRA Table 3.2.2-1—Table 3.2.2-7 and LRA Table 3.2.2-8-1—Table 3.2.2-8-5.
- AUX systems and system components subject to a non-Class 1 fatigue analysis. The Same issues as those listed above for emergency safety feature systems and components apply to the AUX systems and components, with the exception that the relevant aging management review Table 2 tables are given in LRA Table 3.3.2-1—Table 3.3.2-17 and LRA Table 3.3.2-18-1—Table 3.3.2-18-26.
  - Steam and power conversion systems and system components subject to a non-Class 1 fatigue analysis. The same issues as those listed above for emergency safety feature systems and components apply to the steam and power conversion systems and components, with the exception that the relevant aging management review Table 2 tables are given in in LRA Table 3.4.2-1 and LRA Tables 3.4.2-2-1 – 3.4.2-2-4.

The staff also audited the updated safety analysis report supplement's description of the LRA's time-limited aging analysis on Non-Class 1 fatigue, as provided in LRA updated safety analysis report supplement, Section A.2.2.2. The SRP-LR does not include a sample updated safety analysis report supplement for this type of time-limited aging analysis. However, the staff verified that the applicant provided an adequate summary description of the time-limited aging analysis and the basis for dispositioning both the implicit metal fatigue time-limited aging analysis for non-Class 1 piping and inline components and the metal fatigue time-limited aging analysis for non-Class 1, nonpiping components in accordance with the criterion in 10 CFR 54.21(c)(1)(i).

### **License Renewal Application TLAA Section 4.3.3, "Effects of Reactor Water Environment on Fatigue Life"**

Summary of Information in the Application. LRA Section 4.3.3, "Effects of Reactor Water Environment on Fatigue Life," discusses the applicant's evaluation of time-limited aging analysis on environmentally assisted fatigue (TLAA on EAF). The time-limited aging analysis involves the calculations of environmentally-assisted cumulative usage factor ( $CUF_{en}$ ) for components that are included in the reactor coolant pressure boundary (RCPB) of the facility. The applicant dispositioned the time-limited aging analysis on environmentally assisted fatigue for these

components in accordance with 10 CFR 54.21(c)(1)(iii). The applicant also indicated that during the period of extended operation, it will use the implementation of the Fatigue Monitoring Program, as enhanced in LRA Section B.1.18, to manage the impacts of environmentally assisted cumulative fatigue damage or cracking due to fatigue on the intended functions of the components.

The applicant further supplemented LRA Section 4.3.3 with additional information in its letter dated August 1, 2017 (ML17213A064). By submitting the supplement, the applicant intended to resolve the NRC staff's concern in Question 2 regarding the environmentally assisted fatigue analysis methodology. The NRC staff issued this concern in the staff's acceptance review letter to the applicant dated July 10, 2017 (ML17186A159).

To verify that the applicant provided a basis to support its disposition of the time-limited aging analysis, the staff audited the time-limited aging analysis, as supplemented in the applicant's letter of August 1, 2017. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant's staff and reviewed onsite documentation that the applicant provided. The staff did not perform an independent search of the applicant's operating experience database for this time-limited aging analysis because the time-limited aging analysis is based on a programmatic enhancement and commitment in the Fatigue Monitoring Program (LRA AMP B.1.18) to perform future calculations of environmentally assisted fatigue (i.e., EAF calculation or  $CUF_{en}$  calculations). Thus, there has yet to be operating experience with respect to the performance of  $CUF_{en}$  calculations for the reactor coolant pressure boundary components in the plant design.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant's operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
LRA Section 4.3.3	Effects of Reactor Water Environment on Fatigue Life	Revision 0
Entergy Letter No. RBG-47773	Supplement to License Renewal Application, River Bend Station – Unit 1	August 1, 2017
Entergy Engineering Report No. RBS-EP-15-00005	RBS License Renewal Project, TLAA – Mechanical Fatigue	Revision 0
EPRI Report No. 1024995	Environmentally-Assisted Fatigue Screening, Process, and Technical Basis for Identifying EAF Limiting Locations	Revision 0
NUREG/CR-6909	Effect of LWR Coolant Environments on the Fatigue Life of Reactor Materials	February 2007
NUREG/CR-6260	Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plants	March 1995

During the audit of the time-limited aging analysis, the staff audited the time-limited aging analysis to confirm that the applicant has provided an adequate basis for dispositioning this

time-limited aging analysis in accordance with 10 CFR 54.21(c)(1)(iii). The staff found insufficient information to confirm the adequacy of the applicant's basis for its time-limited aging analysis disposition. In order to obtain information to review the acceptability of the applicant's basis that supports its time-limited aging analysis disposition, the staff will consider issuing an RAI for the subject discussed below.

- LRA Section 4.3.3, as supplemented by the applicant's letter dated August 1, 2017, provides additional details on the process the applicant would perform to determine if additional reactor coolant pressure boundary locations may involve more limiting values of  $CUF_{en}$  than those reactor coolant pressure boundary locations that are selected for analysis using the methodology in NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Fatigue Curves to Selected Nuclear Power Plant Components." If the applicant identifies such additional locations, the applicant should analyze them in  $CUF_{en}$  analysis. The LRA supplement indicates that applicant will use a thermal zone analysis approach as its basis for determining whether it needs to analyze additional reactor coolant pressure boundary locations in the  $CUF_{en}$  analysis. However, the staff determined that it may need additional details to further define this thermal zone methodology and clarify how the applicant will apply the methodology to the  $CUF_{en}$  calculations for the Class 1 components.

The staff also audited the updated safety analysis report supplement's description of the LRA time-limited aging analysis on environmentally assisted fatigue, as given in LRA Section A.2.2.3. The staff found insufficient information to determine whether the description provided in the updated safety analysis report supplement was an adequate description of the LRA time-limited aging analysis. In order to verify the sufficiency of the updated safety analysis report supplement program description, the staff will consider issuing an RAI that addresses the adequacy of the applicant's process for identifying additional locations for the  $CUF_{en}$  calculations (i.e., locations other than those identified through the NUREG-6260 methodology).

#### **License Renewal Application Section 4.7.1, "Erosion of Main Steam Line Flow Restrictors"**

Summary of Information in the Application. LRA Section 4.7.1, "Erosion of Main Steam Line Flow Restrictors," discusses the analysis for erosion of the main steam line flow restrictors. The applicant dispositioned the time-limited aging analysis in accordance with 10 CFR 54.21(c)(1)(ii). To verify that the applicant provided a basis to support its disposition of the time-limited aging analysis, the staff audited the time-limited aging analysis. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant's staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

<b>Document</b>	<b>Title</b>	<b>Revision / Date</b>
RBS-EP-15-00004	TLAA and Exemption Evaluation Results	Revision 0
RBS-ME-16-00008	River Bend Station Unit 1 Main Steam Line Flow Restrictors	Revision 0



During the audit of the time-limited aging analysis, the staff verified that the applicant has provided its basis that supports its disposition of 10 CFR 54.21(c)(1)(ii). In addition, the staff found that sufficient information was not available to support its review of the applicant's basis that supports its time-limited aging analysis disposition. In order to obtain information to review the acceptability of the applicant's basis that supports its time-limited aging analysis disposition, the staff will consider issuing RAIs for the subjects discussed below.

- The LRA states that the applicant evaluated the erosion rate for the main steam line flow restrictors and determined that the expected erosion rate would be less than the value in the updated safety analysis report. The applicant determined that with the new erosion rate, the increase in choked flow would be less than the 5 percent value identified in the updated safety analysis report. SRP-LR Section 4.7.2.1 states that the applicant must demonstrate that the analysis has been projected to the end of the extended period of operation. Although the applicant performed an analysis as described in the observation listed below, it is not clear to the staff that the applicant has met the acceptance criterion. LRA Section 4.7.1 does not provide the results or the bases of the projected analysis in the LRA to demonstrate that (1) the intended functions of the components are maintained in accordance with the current licensing basis, and (2) the expected erosion rate would be bounded by the value in the updated safety analysis report.
- The LRA indicates in Table 3.1.2-3 that the applicant is using Water Chemistry—BWR Program and the Flow-Accelerated Corrosion Program to manage the flow restrictors for loss of material. 10 CFR 54.21(a) states, in part, that license renewal applications must identify and list components within scope that are subject to an aging management review and must describe and justify the methods used to demonstrate that the effects of aging will be adequately managed. It is not clear to the staff that the acceptance criterion is met because the applicant did not provide either (1) an aging management review item for the flow restrictors that cites the time-limited aging analysis, or (2) justification why this type of aging management review item would not be necessary for inclusion in the LRA.

During the audit, the staff observed:

- The staff reviewed RBS-EP-15-00004 and RBS-ME-16-00008 and noted that General Electric-Hitachi performed a projected analysis for the erosion rate to support license renewal. The applicant states that the analysis accounts for the 5 percent power uprate and thermal power optimization uprate. The projected analysis considers conservatisms in the original analysis and considers the results of a similar analysis for an advanced boiling water reactor design. The analysis concluded that the total erosion through the period of extended operation and resulting increase in choked flow (in the event of a main steam line break) will remain within the limits identified in the updated safety analysis report for the 40-year license (i.e., the increase in choked flow will remain less than 5 percent at the end of the period of extended operation because the newly calculated erosion rate is less than the 0.004-inches-per-year rate identified in the updated safety analysis report).

The staff also audited the updated safety analysis report supplement's description of the LRA time-limited aging analysis. The staff verified that the updated safety analysis report supplement description is consistent with the SRP-LR description.

## License Renewal Application Section 4.7.2, “Postulation of HELB [High-Energy Line Break] Locations”

Summary of Information in the Application. LRA Section 4.7.2, “Postulation of HELB Locations,” discusses the analysis for the locations subject to high-energy line break (HELB). The applicant dispositioned the time-limited aging analysis in accordance with 10 CFR 54.21(c)(1)(iii). To verify that the applicant provided a basis to support its disposition of the time-limited aging analysis, the staff audited the time-limited aging analysis. Issues that the NRC staff identified but does not resolve in this report, the staff will address in the SER.

Audit Activities. During its audit, the NRC staff interviewed the applicant’s staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that NRC staff reviewed and found relevant to the audit. Either the applicant provided these documents, or the staff identified them by searching the applicant’s operating experience database.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
RBS-EP-15-00004	TLAA and Exemption Evaluation Results	Revision 0
RBS-EP-15-00005	TLAA – Mechanical Fatigue	Revision 0
RBS-EP-17-00006	Fatigue Update for River Bend Nuclear Station using FatiguePro Software	Revision 0

During the audit of the time-limited aging analysis, the staff verified that the applicant has provided its basis that supports its disposition of 10 CFR 54.21(c)(1)(iii). In addition, the staff found insufficient information to support its review of the applicant’s basis that supports its time-limited aging analysis disposition. In order to obtain information to review the acceptability of the applicant’s basis that supports its time-limited aging analysis disposition, the staff will consider issuing RAIs for the subjects discussed below.

- The LRA states that the Fatigue Monitoring Program will manage the aging effects associated with the HELB time-limited aging analysis. SRP-LR Section 4.7.2.1 states that under 10 CFR 54.21(c)(1)(iii), the applicant must demonstrate that it will adequately manage the effects of aging on the intended functions for the period of extended operation. It is not clear to the staff that the applicant met the acceptance criterion because the LRA: (1) does not identify the specific piping systems within the scope of the time-limited aging analysis that are included in the Fatigue Monitoring Program’s cycle counting activities, and (2) does not identify the specific transients used for the HELB time-limited aging analysis that are tracked under the Fatigue Monitoring Program.

During the audit, the staff observed:

- The staff reviewed the LRA, RBS-EP-15-00004, and RBS-EP-15-00005 and noted that the applicant did not identify the specific piping systems within the scope of the time-limited aging analysis that are included in the Fatigue Monitoring Program’s cycle counting activities. The staff also noted that the applicant did not identify the specific

transients used for the HELB time-limited aging analysis that are tracked under the Fatigue Monitoring Program. During audit discussions, the applicant stated that Table 3.6A-21 in the updated safety analysis report is a complete list of pipe systems subject to the HELB cumulative usage factor (CUF) limit of 0.1. The applicant clarified that the table also includes the following: (1) the control rod drive system, which is an ASME Class 2 system not subject to the 0.1 cumulative usage factor criterion, and (2) the reactor recirculation system which was not designed to the 0.1 cumulative usage factor criterion. The applicant also stated that the transients tracked for the 0.1 cumulative usage factor criterion are the same as those tracked for the 1.0 cumulative usage factor.

- The staff reviewed RBS-EP-17-00006 and noted that the applicant has identified multiple systems that it projects will exceed the cumulative usage factor limit of 0.1 before 60 years of operation. Actions to be taken to address components projected to exceed their cumulative usage factor limit will be evaluated as part of the Corrective Actions element of the Fatigue Monitoring Program, LRA Section B.1.18.

The staff also audited the updated safety analysis report supplement's description of the LRA time-limited aging analysis. The staff verified that the updated safety analysis report supplement description is consistent with the SRP-LR description.

#### **License Renewal Application TLA Section 4.7.4, Crane Load Cycles Analysis**

Summary of Information in the Application. LRA Section 4.7.4, "Crane Load Cycles Analysis," discusses the analyses for the spent fuel cask trolley (SFCT) crane, the reactor building polar crane, and the fuel building bridge crane. The applicant dispositioned the time-limited aging analysis in accordance with 10 CFR 54.21(c)(1)(i).

To verify that the applicant provided a basis to support its disposition of the time-limited aging analysis, the staff audited the time-limited aging analysis.

Audit Activities. During its audit, the NRC staff interviewed the applicant's staff and reviewed onsite documentation that the applicant provided.

The table below lists the documents that NRC staff reviewed and found relevant to the audit.

**RELEVANT DOCUMENTS REVIEWED BY NRC STAFF**

Document	Title	Revision / Date
TLAA Reference 16	CMAA-70 Specification for Electric Overhead Traveling Cranes	1975
RBS USAR	Chapter 9, Auxiliary Systems	Revision 24
RBS USAR	Chapter 3, Design of Structures, Components, Equipment, and Systems	Revision 24
RBS-EP-15-00004	"TLAA and Exemption Evaluation Results" Section 2.7.5, "Crane and Trolley (Heavy Load) Cycles"	Revision 0
RBS-CS-15-00003	Engineering Report: AMR of the Turbine Building, Auxiliary Building, and Yard Structures (summarizes functionality and support of various in-scope cranes)	03/24/2017
RBS EP-15-00005	TLAA-Mechanical Fatigue	Revision 0

During the audit of the time-limited aging analysis, the staff verified that the applicant has provided its basis that supports its disposition of 10 CFR 54.21(c)(1)(i).

During the audit, the staff observed:

- Section 2.7.5, "Crane and Trolley (Heavy Load) Cycles," of RBS-EP-15-00004, "TLAA and Exemption Evaluation Results," describes the methodology the applicant used in LRA Section 4.7.4 to estimate the number of lifts for the CMAA-70-listed cranes through the period of extended operation. The applicant based its estimate on an 18-month refueling cycle (although RBS currently follows a 24-month refueling cycle) further incremented by 25 percent to account for construction lift cycles for each of the identified cranes. In summary, RBS-EP-15-00004 states that the estimated lift (loading) cycles through the period of extended operation for the crane time-limited aging analyses listed in LRA Section 4.7.4 are as follows:
  - SFCT crane: 100 (lift cycles/refueling outage (RFO)) X 40 (RFOs) X 1.25 (construction lift cycles) = 5,000 lift cycles
  - fuel building bridge crane: 800 (lift cycles/RFO) X 40 (RFOs) X 1.25 (construction lift cycles) = 40,000 lift cycles
  - reactor building polar crane (main hook): 20 (lift cycles/RFO) X 40 (RFOs) X 1.25 (construction lift cycles) = 1,000 lift cycles
  - reactor building polar crane (auxiliary hook): 780 (lift cycles/RFO) X 40 (RFOs) X 1.25 (construction lift cycles) = 39,000 lift cycles
- The staff reviewed RBS EP-15-00005 and noted that it discusses a non CMAA-70-related time-limited aging analysis for the polar crane evaluated in RBS LRA Time-Limited Aging Analysis 4.6. The staff will review this time-limited aging analysis in SER Section 4.6.

The staff also audited the updated safety analysis report supplement's description of the LRA time-limited aging analysis. The staff verified that the updated safety analysis report supplement description is consistent with the SRP-LR description.