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William F. Maguire
Site Vice President
River Bend Station

RBG-47834

March 8, 2018

Attn: Document Control Desk
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: Response to License Renewal Application NRC Request for Additional Information (RAI) Set 9
River Bend Station, Unit 1
Docket No. 50-458
License No. NPF-47

References: 1) Entergy Letter: License Renewal Application (RBG-47735 dated May 25, 2017)

2) NRC email: River Bend Station, Unit 1, Request for Additional Information, Set 9 – RBS License Renewal Application – dated February 7, 2018 (ADAMS Accession No. ML18038B470)

Dear Sir or Madam:

In Reference 1, Entergy Operations, Inc (Entergy) submitted an application for renewal of the operating license for River Bend Station (RBS) for an additional 20 years beyond the current expiration date. In an email dated February 7, 2018, (Reference 2) the NRC staff made a Request for Additional Information (RAI), needed to complete the license renewal application review. Enclosure 1 provides the responses to the Set 9 RAIs. Enclosure 2 identifies a commitment noted in Enclosure 1.

If you require additional information, please contact Mr. Tim Schenk at (225)-381-4177 or tschenk@entergy.com.

In accordance with 10 CFR 50.91(b)(1), Entergy is notifying the State of Louisiana and the State of Texas by transmitting a copy of this letter to the designated State Official.

I declare under penalty of perjury that the foregoing is true and correct. Executed on March 8, 2018.

Sincerely,

WFM/RMC/alc

Enclosure 1: Responses to RAIs Set 9 – River Bend Station
Enclosure 2: Commitment – River Bend Station

cc: (with Enclosure)

U. S. Nuclear Regulatory Commission
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cc: (w/o Enclosure)

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RBF1-18-0037

RBG-47834

Enclosure 1

Responses to Request for Additional Information

Set 9

REQUEST FOR ADDITIONAL INFORMATION
LICENSE RENEWAL APPLICATION
RIVER BEND STATION, UNIT 1 – SET 9
DOCKET NO.: 50-458
CAC NO.: MF9757
Office of Nuclear Reactor Regulation
Division of Materials and License Renewal

Question
RAI B.1.17-1 (External Surfaces Monitoring)

Background
During its onsite audit, the staff walked down portions of the diesel generator building and noted that the air intake plenums, under normal operating conditions, draw outside air directly into the diesel generator rooms, without any conditioning of the ambient air. This is also represented on LRA Drawing PID-22-07A, "HVAC Diesel Generators."

LRA Table 3.0-1, "Service Environments for Mechanical Aging Management Reviews," states that the River Bend environment of "air-indoor" corresponds to "air-indoor uncontrolled" in the GALL Report. GALL Report Section IX.D, "Environments," defines "air-indoor uncontrolled" as an environment with temperatures higher than dew point (i.e., condensation can occur, but only rarely) and "air –outdoor" as an environment consisting of moist, possibly salt laden atmospheric air, ambient temperatures and humidity, and exposure to weather, including precipitation.

NRC Standard Review Plan for License Renewal Applications (SRP-LR), Sections 3.2.2.2.3.2, 3.2.2.2.6, 3.3.2.2.3, 3.3.2.2.5, 3.4.2.2.2, and 3.4.2.2.3 discuss the possibility of aging effects extending to stainless steel components exposed to air "which has recently been introduced into buildings (i.e., components near intake vents)." The corresponding LRA sections state that there are no indoor stainless steel components located near unducted air intakes in engineered safety features, auxiliary, or steam and power conversion systems.

Issue
For in scope components in the diesel generator building (e.g., items in LRA Tables 3.3.2 10, "Standby Diesel Generator," 3.3.2 11, "HPCS Diesel Generator," 3.3.2 18 12, "Standby Diesel Generator System Nonsafety Related Components Affecting Safety Related Systems," 3.3.2 18 13, "HPCS Diesel Generator System Nonsafety Related Components Affecting Safety Related Systems," 3.3.2 17, "Fuel Oil System"), it is unclear to the staff why the air environment in this building is considered "air indoor" given that, under normal operating conditions, outdoor air is drawn directly into the diesel generator rooms. Other than being protected from exposure to weather, components in these systems appear to be exposed to an environment where condensation from humid air can occur relatively frequently, contaminants from cooling tower treatment chemicals may be present, and chlorides from atmospheric air may be present. The staff notes that some materials exposed to air-indoor will have no aging effects requiring management whereas these materials will have aging effects requiring management (e.g., loss of material for stainless steel, aluminum; cracking for stainless steel) for exposure to air which has recently been introduced into buildings.

In addition, based on the staff's walkdown of the diesel generator building during its onsite audit, it is unclear to the staff how the applicant determined that the indoor stainless steel components are not located near unducted air intakes as stated in LRA Sections 3.2.2.2.3.2, 3.2.2.2.6, 3.3.2.2.3, 3.3.2.2.5, 3.4.2.2.2, and 3.4.2.2.3. It is also unclear to the staff if there are ducted air intakes which could result in stainless steel components located inside buildings being exposed to outdoor air.

Request

1. Provide information that establishes the "air-indoor" environment cited for components inside the diesel generator building for the LRA tables discussed above. Include information that addresses normal operating conditions, where outdoor air is drawn directly into the diesel generator rooms and its impact on whether condensation occurs on components more than rarely, as described in the corresponding definition of the GALL Report.

2. In light of the staff's observation during its walkdown of the diesel generator building, provide information that establishes there are no indoor stainless steel components located near ducted or unducted air intakes in engineered safety features, auxiliary, or steam and power conversion systems. Include information that addresses the associated sections of SRP-LR regarding components exposed to air that has been recently introduced into buildings.

Response

1. The external surfaces of stainless steel components within the diesel generator building are exposed to air recently introduced into the building. Outdoor air travels upward through horizontally mounted screens before entering ventilation air intake plenums through vertically mounted dampers. The dampers include 0.5-inch wire mesh screens. Air then enters the diesel rooms through horizontal openings in the bottom of the intake plenum. Exposure to precipitation is the primary difference between air-indoor and air-outdoor environments. The intake air path precludes precipitation from affecting components in the building.

   Condensation is an external environment conservatively cited in the LRA for service water components within the diesel building because those components can operate at temperatures below the dew point. Whether outdoor air has recently been introduced into the building is expected to have minimal, if any, effect on the degree of condensation. Condensation has rarely been observed on components in the building. Because condensation is rarely expected and the path that air must travel to enter the diesel generator building precludes precipitation from affecting components in the building, an indoor air environment is appropriate.

2. Numerous stainless steel components included in the LRA are exposed to outdoor air, including accumulators, filter housings, flow elements, piping, tubing, and valves, among others. These components are included in LRA Section 3 tables with cracking as an applicable aging effect; however, after being in service for over 30 years, cracking has not been observed. Operating experience review did not reveal failures or concerns related to stress corrosion cracking (SCC) of stainless steel components due to contaminants in outdoor air within engineered safety features, auxiliary, or steam and power conversion systems.

   As described in NUREG-1800, Rev. 2, Standard Review Plan for Review of License Renewal Applications for Nuclear Power Plants (SRP-LR), applicable air environments that could initiate SCC in stainless steel components include, but are not limited to, those within approximately 5 miles of a saltwater coastline, those within 1/2 mile of a highway which is treated with salt in the wintertime, those areas in which the soil contains more than trace chlorides, those plants having cooling towers where the water is treated with chlorine or chlorine compounds, and those areas subject to chloride contamination from other agricultural or industrial sources. Although most of the criteria cited in the SRP-LR do not apply to River Bend Station, sufficient data is not available to determine that SCC will not occur during the period of extended operation. Thus, a surface examination will be performed in accordance with the One-Time Inspection Program on stainless steel components externally exposed to outdoor air to verify SCC is not occurring. It is reasonable to conclude that stainless steel components located indoors are less susceptible to SCC due to contaminants entrained in the air than those exposed to an outdoor environment. Therefore, one-time inspections of components exposed to outdoor air will be bounding of components exposed to indoor air.

Changes to the LRA follow with additions underlined and deletions lined through.

3.3.2.2.3Cracking due to Stress Corrosion Cracking

Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements, and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Water in the RBS cooling towers is treated with chlorine compounds. Chloride contamination of components exposed to outdoor air may occur. Consistent with NUREG-1801 for outdoor air with a potential source of chloride contamination, cracking of stainless steel components directly exposed to outdoor air is identified as an aging effect requiring management and is managed by the External Surfaces Monitoring Program. There are no stainless steel auxiliary systems components in the scope of license renewal that are located indoors near unducted air intakes. The One-Time Inspection Program uses NDE surface examinations of stainless steel components exposed to outdoor air to verify cracking of stainless steel components exposed to indoor air, regardless of proximity to outside air intakes, is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.

3.4.2.2.2 Cracking due to Stress Corrosion Cracking (SCC)

Cracking due to stress corrosion cracking could occur for stainless steel piping, piping components, piping elements and tanks exposed to outdoor air, including air which has recently been introduced into buildings, such as near intake vents. Water in the RBS cooling towers is treated with chlorine compounds. Chloride contamination of components exposed to outdoor air may occur. Consistent with NUREG-1801 for outdoor air with a potential source of chloride contamination, cracking of stainless steel components directly exposed to outdoor air is identified as an aging effect requiring management and is managed by the External Surfaces Monitoring Program. ~~There are no stainless steel steam and power conversion system components in the scope of license renewal that are located indoors near unducted air intakes.~~ The One-Time Inspection program uses NDE surface examinations of component in outdoor air to confirm that cracking of stainless steel components exposed to indoor air, regardless of proximity to outside air intakes, is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.

A.1.32 One-Time Inspection

The program will include activities to verify effectiveness of aging management programs and activities to confirm the insignificance of aging effects as described below.

A representative sample of internal and external surfaces of RCIC piping passing through the waterline region of the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
A representative sample of stainless steel component external	A one-time surface examination will confirm that cracking of components in indoor air is not occurring

<u>surfaces exposed to outdoor air</u>	<u>or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.</u>

B.1.32 ONE-TIME INSPECTION

Program Description

The program will include activities to verify effectiveness of aging management programs and activities to confirm the insignificance of aging effects as described below.

A representative sample of internal and external surfaces of RCIC piping passing through the waterline region of the suppression pool	One-time inspection activity will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.
<u>A representative sample of stainless steel component external surfaces exposed to outdoor air</u>	<u>A one-time surface examination will confirm that cracking of components in indoor air is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.</u>

<u>Question</u>

RAI B.1.17-2 (External Surfaces Monitoring)

<u>Background</u>
GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," recommends inspections for leakage to identify cracking of stainless steel external surfaces exposed to air environments containing halides.

LRA Section B.1.17 states that inspection parameters include leakage for detection of cracks on the external surfaces of stainless steel components exposed to an air environment containing halides. LRA Tables 3.3.2 10, 3.3.2 11, and 3.3.2 12, "Control Building HVAC System," contain AMR items for stainless steel components exposed to an outdoor air external environment and an exhaust gas or outdoor air internal environment. Cracking is managed for these components with the External Surfaces Monitoring program.

<u>Issue</u>
For stainless steel components that have an internal environment of exhaust gas or outdoor air, it is not clear to the staff how inspections of external surfaces will effectively use leakage as an indicator of cracking.

<u>Request</u>
Provide information regarding the inspection parameters and the inspection methods that will be used to determine whether cracking is present in the stainless steel components exposed to outdoor air in LRA Tables 3.3.2 10, 3.3.2 11, and 3.3.2 12 with an exhaust gas or outdoor air internal environment.

Response

a. LRA Table 3.3.2-10 and LRA Table 3.3.2-11

The standby diesel generator system (LRA Table 3.3.2-10) includes stainless steel piping in an external environment of air-outdoor with an internal environment of exhaust gas. The HPCS diesel generator system (LRA Table 3.3.2-11) includes stainless steel piping in an external environment of air-outdoor with an internal environment of exhaust gas.

Leaking exhaust gas will stain the stainless steel surface. Piping inspection methods include visual observations for staining which may be indicative of cracking on the piping external surfaces in accordance with NUREG-1801 Section XI.M36, as identified in LRA Section B.1.17. The surface condition is monitored for comparison to the conditions described in the acceptance criteria program element. LRA Section B.1.17, External Surfaces Monitoring, includes an enhancement to the acceptance criteria program element. This enhancement states that "Stainless steel should have a clean, shiny surface with no discoloration."

b. LRA Table 3.3.2-12

The control building HVAC system (LRA Table 3.3.2-12) includes stainless steel sampling manifolds located inside system ducting. Since these stainless steel manifolds are located inside ducting, the environment should have been identified as air – indoor, instead of air – outdoor, with no aging effects requiring management.

The changes to LRA Table 3.3.2-12 follow with additions underlined and deletions lined through.

Table 3.3.2-12: Control Building HVAC System

Component Type	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Programs	NUREG-1801 Item	Table 1 Item	Notes
Manifold	Pressure boundary	Stainless steel	~~Air – outdoor (ext)~~ Air – indoor (ext)	~~Cracking~~ None	~~External Surfaces Monitoring~~ None	~~VII.F1.AP-209~~ VII.J.AP-123	~~3.3.1.4~~ 3.3.1-120	A
Manifold	Pressure boundary	Stainless steel	~~Air – outdoor (ext)~~ Air – indoor (int)	~~Loss of material~~ None	~~External Surfaces Monitoring~~ None	~~VII.F1.AP-221~~ VII.J.AP-123	~~3.3.1.6~~ 3.3.1-120	A
~~Manifold~~	~~Pressure boundary~~	~~Stainless steel~~	~~Air – outdoor (int)~~	~~Cracking~~	~~Internal Surfaces in Miscellaneous Piping and Ducting Components~~	~~--~~	~~--~~	~~G~~

~~Manifold~~	~~Pressure boundary~~	~~Stainless steel~~	~~Air – outdoor (int)~~	~~Loss of material~~	~~Internal Surfaces in Miscellaneous Piping and Ducting Components~~	~~--~~	~~--~~	~~G~~

Question
RAI B.1.17-3 (External Surfaces Monitoring)

Background
In support of its integrated plant assessment, River Bend Station (RBS) prepared report RBS EP 15-00007, Revision 0, "Aging Management Program Evaluation Results – Non-Class 1 Mechanical," to demonstrate that the programs credited in the license renewal aging management review reports are adequate to support license renewal. The RBS report states that it identifies the applicable program procedures and controlling documentation and describes the program elements required to support the RBS license renewal application. For the "acceptance criteria" program element, RBS-EP-15-00007 Section 4.5 states that the External Surfaces Monitoring program uses the guidance described in EN-DC-178, "System Walkdowns." EN DC 178, Attachment 9.4, includes "paint and preservation inadequate," "evidence of corrosion," and "coatings not intact" as examples of typical indications of age-related degradation. EN-DC-178 states that deficiencies identified during a walkdown should be documented (on walkdown sheets, or on Attachment 9.3, "Resolution of Walkdown Inspection Findings") and resolved in the appropriate manner.

Issue
During its on-site 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 resulting in broad evidence of corrosion. In addition, during its review of operating experience, the staff identified CR-RBS-2014-03643 and CR-RBS-2016-02355 that address general coating degradation and corrosion of service water piping in these tunnels. Based on the walkdown observation, it is not clear to the staff whether existing periodic system walkdowns prescribed by EN-DC-178 identified and documented any corresponding results. It is also not clear to the staff whether there are any pending issue resolution activities, as described in EN DC-178, Attachment 9.3 associated with the ongoing corrosion of the service water piping.

Request
Provide additional information to show that existing activities for the External Surfaces Monitoring program, as prescribed by EN-DC-178, identified and documented inadequate paint / preservation, evidence of corrosion, or degraded coatings for service water piping in the underground connecting tunnels. Include a discussion of any pending issue resolution activities, as described in EN-DC-178, associated with the ongoing corrosion of the service water piping.

Response
The External Surfaces Monitoring Program manages aging effects such as loss of material through periodic visual inspections. For periodic system inspections, EN-DC-178, "System Walkdowns," is used. Inspections in accordance with EN-DC-178 are performed by qualified personnel at least once every refueling cycle to document and evaluate deficiencies under the corrective action program. Numerous condition reports have documented the corrosion and coating degradation addressed by this RAI and system walkdowns have been performed; however, no documentation was found verifying that engineering inspections conducted in accordance with EN-DC-178 noted the deficiency or caused the

deficiency to be evaluated under the corrective action program. In addition, no documentation was found verifying that issue resolution activities are pending as a result of EN-DC-178 guidance. A condition report has been written to address deficiencies in the documentation of walkdowns performed in accordance with EN-DC-178.

As a result of evaluation under the corrective action program, recent activities have been completed in the tunnels to repair corrosion and coating degradation on service water components. Furthermore, additional repairs are scheduled for corrosion and coating degradation on service water piping in the tunnels.

Question

RAI B.1.21-1 (Flow-Accelerated Corrosion)

Background

In support of its integrated plant assessment, River Bend Station (RBS) prepared report RBS-EP-15-00007, Revision 0, "Aging Management Program Evaluation Results – Non-Class 1 Mechanical," to demonstrate that the programs credited in the license renewal aging management review reports are adequate to support license renewal. The RBS report states that it identifies the applicable program procedures and controlling documentation and describes the program elements required to support the RBS license renewal application. For the "scope of program" program element, RBS-EP-15-00007 Section 4.8, "Flow-Accelerated Corrosion," states that the program uses the guidance described in EPRI NSAC-202L, Revision 4, "Recommendations for an Effective Flow-Accelerated Corrosion Program," and cites program procedures SEP-FAC-RBS-001, "Flow-Accelerated Corrosion," and EN-DC-315, "Flow-Accelerated Corrosion Program." In addition, RBS-EP-15-00007 states that, for this aspect, the Flow-Accelerated Corrosion program is consistent with GALL Report AMP XI.M17, "Flow-Accelerated Corrosion."

Issue

RBS-EP-15-00007 states that the program uses the guidance from NSAC 202L, Revision 4; however, implementing procedures SEP-FAC-RBS-001, and EN-DC-315 state that the program uses guidance from NSAC-202L, Revision 3. In addition, GALL Report AMP XI.M17 states that the program uses the guidance in NSAC-202L, Revision 2 or Revision 3. Consequently, it is unclear to the staff whether the program will use guidance in Revision 4 of NSAC-202L, as stated in RBS-EP-15-00007, or whether the program will use the guidance in Revision 3 of NSAC-202L, as stated in the associated implementing procedures SEP-FAC-RBS-001 and EN-DC-315, and in GALL Report AMP XI.M17.

Request

Clarify which revision of NSAC 202L is used for guidance in the RBS Flow-Accelerated Corrosion program. If inconsistencies are identified between the applicable revision of NSAC 202L referenced in the integrated plant assessment and the program's implementing procedures or the GALL Report AMP XI.M17, address how these inconsistencies will be resolved.

Response

NSAC-202L, Revision 4, is used for guidance in the RBS Flow-Accelerated Corrosion Program.

EPRI periodically revises NSAC-202L to update flow-accelerated corrosion program recommendations with the experience of members of the CHECWORKS Users Group (CHUG), and recent developments in detection, modeling, and mitigation technology. These recommendations refine and enhance those of earlier versions and ensure the continuity of existing flow-accelerated corrosion programs. The technical changes in NSAC-202L-R4 represent improvements in the management of flow-accelerated corrosion and

ensure that the main objective of flow-accelerated corrosion programs, which is to manage wall thinning, is maintained. Use of NSAC-202L-R4 for Flow-Accelerated Corrosion program guidance has been deemed acceptable in NUREG-2205, *"Safety Evaluation Report Related to the License Renewal of LaSalle County Station Units 1 and 2,"* and in NUREG-2191, *"Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report."*
Because NUREG-1801, Section XI.M17 states that the program uses the guidance in NSAC-202L, Revision 2 or Revision 3, an exception is added to the RBS Flow-Accelerated Corrosion Program description.

The changes to LRA Table B-3 and Section B.1.21 follow with additions underlined and deletions lined through.

Table B-3
RBS Program Consistency with NUREG-1801

		NUREG-1801 Comparison	
Program Name	**Plant-Specific**	**Program has Enhancements**	**Program has Exceptions to NUREG-1801**
Flow-Accelerated Corrosion [B.1.21]		X	X

B.1.21 Flow-Accelerated Corrosion
Exceptions to NUREG-1801

~~None~~

The Flow-Accelerated Corrosion Program has the following exception.

Element Affected	**Exception**
1. Scope of Progam 4. Detection of Aging Effects 5. Monitoring and Trending 6. Acceptance Criteria	The Flow-Accelerated Corrosion Program described in Section XI.M17 of NUREG-1801 relies on implementation of the Electric Power Research Institute (EPRI) guidelines in Nuclear Safety Analysis Center (NSAC)-202L-R2 or -R3 for an effective flow-accelerated corrosion program. The RBS Flow-Accelerated Corrosion Program is based on NSAC-202L-R4.[1]

Basis for Exception

1. EPRI periodically revises NSAC-202L to update flow-accelerated corrosion program recommendations with the experience of members of the CHECWORKS Users Group (CHUG), and recent developments in detection, modeling, and mitigation technology. These recommendations refine and enhance those of earlier versions and ensure the continuity of existing flow-accelerated corrosion programs. The technical changes in NSAC-202L-R4 represent improvements in the management of flow-accelerated corrosion and ensure that the main objective of flow-accelerated corrosion programs, which is to manage wall thinning, is maintained. Use of NSAC-202L-R4 for Flow-Accelerated Corrosion Program guidance has been deemed acceptable in NUREG-2205, "Safety Evaluation Report Related to the License Renewal of LaSalle County Station Units 1 and 2," and in NUREG-2191, "Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report."

Question
RAI B.1.21-2 (Flow-Accelerated Corrosion)

Background
For the "detection of aging effects" program element, Section 4.8 of RBS EP 15 00007 cites procedure EN-DC-315, "Flow-Accelerated Corrosion [FAC] Program," as the basis for being consistent with the GALL Report AMP XI.M17. Procedure EN-DC-315 states that specific software programs (i.e., "CHECWORKS" and "FAC Manager Web Edition") shall be used in determining the remaining component life. Based on discussions during the AMP Audit breakout session, both software programs are classified as Level C, which does not require verification/validation activities. GALL Report AMP XI.M17 states that the FAC program is described in NSAC-202L and that components are suitable for continued service if the predicted wall thickness at the next scheduled inspection is greater than or equal to the minimum allowable wall thickness. NSAC-202L, Section 2, "Elements of an Effective FAC Program," provides recommendations for ensuring that appropriate quality assurance is applied, including properly documenting work. Entergy report EC-0000072133, "RF-19 Post-Outage Report," includes a signed output sheet from FAC Manager, which contains wall thickness data and the measured wear rate from each inspection.

Issue
For safety-related components, it is not clear to the staff that the remaining component life is being properly determined because the wear rate values are taken from Level C software (i.e., "CHECWORKS" and "FAC Manager Web Edition"), which does not require validation and verification activities. Although the FAC Manager output sheets are signed as prepared and verified, the determination of the wear rate values cannot be independently verified based on the information provided.

Request
Provide additional information to show that appropriate quality assurance has been applied to the calculated wear rates used in the determination of the schedule for inspection of safety-related components.

Response
CHECWORKS and FAC Manager Web Edition (FMWE) are Level C software which is used for day-to-day support activities and whose loss or failure would not affect the immediate ability to operate the plant but could threaten the plant's long-term ability to operate. The Level C classification is appropriate because the software is not embedded in or integral to a safety-related (SR) structure, system or component (SSC), is not utilized in the design process of SR SSCs, is not embedded in or an integral part of a non-safety related (NSR) SSC used to support or maintain an important to safety SSC (e.g. surveillance, calibration, post-maintenance test), is not used to determine Technical Specification, NRC regulation/commitment or 10CFR50 compliance, and is not used to calibrate or maintain maintenance and test equipment (M&TE) used on safety-related or Technical Specification SSCs.

Level C software does not require "verification," which consists of evaluating and analyzing products of each life cycle phase (e.g., requirements specification, design descriptions, code, and databases) through testing and reviews or audits to discover and correct deficiencies as early as possible. However, the CHECWORKS code was developed in accordance with the quality assurance policies of EPRI, which require a formal software plan and detailed program documentation. These policies also mandate that a list of program bugs be maintained. The FMWE code was developed in accordance with the quality assurance policies of Altran, which also require a formal testing plan, detailed program documentation, and a list of program bugs.

Level C software does require "validation," which is the final testing activity and ensures that the software installation and integration into the production environment is successful. The installation is performed in accordance with a documented plan or vendor instructions which may include sample program inputs and outputs for use in verifying installation.

Predictive model CHECWORKS is just one of the tools used to determine inspection eligibility and priority. Selection of inspection locations for an outage is based on the following factors.

- previous inspection results
- CHECWORKS susceptibility ranking
- industry and plant-specific operating experience
- components selected to calibrate CHECWORKS
- components subject to off normal flow conditions, such as caused by a leaking valve
- susceptible non-modeled small bore piping that has not been inspected

Measurement of actual wall thickness during inspections is the primary tool used in the FAC Program to determine component wear. The measured wall thickness is used to determine wear rates, predicted thickness, and remaining service life in FAC Manager Web Edition (FMWE) according to the following steps.

- Initial thickness of a component is determined by ultrasonic inspection prior to the component being placed in service or in the first ultrasonic inspection during its service life. If an examination has not previously been performed on the component, the initial thickness is determined by reviewing the initial ultrasonic data for that component. The area of maximum wall thickness within the same region as the worn area is identified. If the thickness is greater than the nominal component wall thickness, the maximum wall thickness within the relevant area is used as the initial thickness. If that thickness is less than the nominal wall thickness, the nominal wall thickness is used as the initial thickness.
- The projected wear rate is calculated by dividing the wear by the time between measurements or the time between when the component was placed in service and the time of the measurement. Wear is the amount of material removed or lost from a components wall thickness since baseline or subsequent to being placed in service and time is the actual plant operating hours, although calendar hours may be used for conservatism.
- The remaining service life (RSL) is determined by subtracting the minimum acceptable wall thickness from the actual measured wall thickness, then dividing by the wear rate times a safety factor of 1.1.
- If the RSL of a component is greater than or equal to the number of hours in the next operating cycle, the component may be returned to service. If the component's RSL is greater than the number of hours in the next operating cycle but is less than the number of hours in the next two operating cycles, the component should be considered for re-inspection, repair or replacement during the next scheduled outage. If the component is acceptable for continued service, it shall be re-examined before, or during the cycle during which it is projected to wear to the minimum acceptable wall thickness.

Evaluation of wear rates, predicted thickness, and remaining service life is documented and reviewed by qualified FAC personnel or designated personnel qualified in accordance with the engineering calculation process. Therefore, appropriate quality assurance is applied to the calculated wear rates used in the determination of the schedule for inspection of safety-related components.

Question
RAI B.1.21-3 (Flow-Accelerated Corrosion)

Background
For the "detection of aging effects" program element, Section 4.8 of RBS EP 15 00007 cites procedure EN-DC-315, "Flow-Accelerated Corrosion [FAC] Program," as the basis for being consistent with the GALL Report AMP XI.M17. For FAC component FWSEP17B030P1-CC#6, Entergy report EC-0000072133, "RF-19 Post-Outage Report," includes a note indicating that the inspection was due to a leaking system valve. The associated FAC Manager report also states that the nominal thickness of the 20-inch pipe is 1.969 inches, with the measured wear of 0.256 inches and a calculated wear rate of 10.555 mils per year. The staff notes that the calculated wear rate appears to be based on the overall service life of the component, approximately 24 years.

Issue
The calculated wear rate is based on the assumption that the wear took place over a significant portion of the life of the component. However, there is a possibility that the leaking valve caused a much higher wear rate, potentially underestimating the likelihood of the component failure given another occurrence of the leaking valve in the future. Although the program appears to appropriately inspect components downstream of leaking valves, using the calculated wear rate based on the current methodology potentially causes non-conservative information to be used for evaluating the probability of a future component failure with the leaking valve. It is not clear to the staff how the program addresses the potential for higher than calculated wear rates for "abnormal" yet likely occurrences of leaking valves in the future.

Request
Provide additional information to show how the program considers the potential for higher than currently calculated wear rates for "abnormal" yet likely occurrences of leaking valves in the future.

Response
Engineering procedures provide guidance on selecting components for inspection when "abnormal" conditions are experienced in the plant. When isolation boundaries are believed to be challenged and the potential for increased wear rate exists, downstream piping components are scheduled for inspections based on procedural guidance. The results of the examination are reviewed and based on analysis; a qualified FAC engineer uses industry guidance (i.e., EPRI TR1011231) to determine if the "abnormal" condition had any additional impact on the downstream component. Engineering analysis of the examination data is also used to determine the "abnormal" condition's effects on wear rates. Should a review of the examination data indicate localized degradation beyond what was originally predicted, it would be reasonable to assume the isolation boundary failure initiated an erosion mechanism and the potential for additional wear would be attributed to the timeframe during which the "abnormal" condition existed. However, should the degradation be throughout the general area and within predicted ranges, then it would be assumed that FAC is the primary degradation mechanism and the timeframe used to calculate wear rate will be the component's active service hours as was the case for components downstream of FWS-FV104. Once the "abnormal" condition is mitigated, inspections of the downstream components are scheduled based on expected wear rates due to normal operation.

Question
RAI B.1.39-2 (Selective Leaching)

Background
LRA Sections A.1.39 and B.1.39 state that "[f]or buried components with coatings, no selective leaching inspections are necessary where coating degradation has not been identified."

The "detection of aging effects" program element of GALL Report AMP XI.M33, "Selective Leaching," as modified by LR ISG 2015 01, "Changes to Buried and Underground Piping and Tank Recommendations," states 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."

Issue
During the audit, the staff reviewed plant specific documents and concluded that it is unclear whether in scope buried gray cast iron components are coated. The recommendation to not perform selective leaching inspections of buried components is based on the external coating being in accordance with Table XI.M41 1 of AMP XI.M41 as noted in the Background section above.

Request
1. State what type and whether coatings were specified to be applied to all in scope gray cast iron buried components. If the types of coatings are not consistent with the recommended coating types in AMP XI.M41, state the basis for their effectiveness at preventing loss of material due to selective leaching.

2. If coatings were not specified to be applied to all in scope gray cast iron buried components, state the changes to the "detection of aging effects" program element necessary to address selective leaching inspections of the external surfaces of buried components where coatings were not specified to be applied.

Response
1. RBS design documents specify the application of coal tar epoxy coating to the buried piping in the systems that are within the scope of license renewal. A substitute coating of Tnemec HS 104 epoxy, which is a cycloaliphatic amine epoxy, is allowed by the specification for field-installed piping. Tnemec HS 104 conforms to the recommendations of American Water Works Association (AWWA) C210 "Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings" when installed in underground and underwater applications. It protects in immersion, salt spray and chemical exposures, and is applied in two coats at a minimum 6 mil dry film thickness each. It has superior abrasion resistance. As such it is an appropriate coating for preventing loss of material due to selective leaching on gray cast iron piping.

2. Coatings were specified to be applied to in-scope buried piping.

Question
RAI B.1.40-1 (Service Water Integrity)

Background
In support of its integrated plant assessment, River Bend Station (RBS) report RBS-EP-15-00007, Revision 0, "Aging Management Program Evaluation Results – Non Class 1 Mechanical," to demonstrate that the programs credited in the license renewal aging management review reports are adequate to support license renewal. The RBS report states that it identifies the applicable program procedures and controlling documentation and describes the program elements required to support the

RBS license renewal application. For the "scope of program" program element, RBS-EP-15-00007 Section 4.11, "Service Water Integrity," states that there is no piping in the scope of its Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment," response; therefore, no piping is in the scope of the Service Water Integrity program. LRA Table 3.3.2-3, "Service Water System," indicates that the aging effects for piping exposed internally to raw water will be managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components and Flow-Accelerated Corrosion programs.

GL 89-13 Action item III addresses establishing a routine inspection and maintenance program for service water system piping and components to ensure corrosion, erosion, and other problems cannot degrade the performance of the service water system. The 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 for service water piping and components to ensure that corrosion, erosion, protective coating failure, silting, and biofouling will not degrade the performance of the service water system.

Plant-specific condition report, CR-RBS-2010-06697 states that inaccessible piping submerged in the standby service water basin has not been inspected since initial installation and because it was inaccessible, the GL 89-13 recommendation for Action Item III was not recognized as being applicable to this piping.

<u>Issue</u>
The staff notes that GL 89-13 distinguishes between open-cycle and closed-cycle systems and states that a system is to be considered an open-cycle system, with regard to the specific actions required by the GL, if the system rejects heat directly to a heat sink. The staff notes that although portions of the service water system have been converted to a closed-cooling water system, there are some portions of the system containing raw water that reject heat directly to a heat sink and would be classified as an open-cycle system according to the GL. The staff further notes that 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 GL 89-13 Action Item III. In addition, based on CR-RBS-2010-06697, after recognizing that submerged piping in the standby service water basin is within the scope of GL 89-13 Action Item III, RBS began to perform inspections of the piping as part of the GL 89 13 program.

The staff notes that although loss of material due to corrosion for piping exposed to raw water may be managed by RBS' Internal Surfaces in Miscellaneous Piping and Ducting Components program, the corresponding GALL Report AMP XI.M38 excludes piping and components that are within the scope of the open-cycle cooling water system. The staff also notes that the LRA identifies the Internal Surfaces in Miscellaneous Piping and Ducting Components program as a new program (i.e., is not an existing program) that will be implemented prior to 2025.

Based on the RBS responses to GL 89-13 Action Item III, it is unclear to the staff why the piping exposed to raw water in the service water system is not within the scope of the Service Water Integrity program, as stated in Section 4.11 of RBS-EP-15-00007.

<u>Request</u>
Provide information to clarify whether piping exposed to raw water in the open-cycle cooling water system (as defined by GL 89-13) is excluded from the RBS GL 89-13 responses, such that there is no piping within the scope of the Service Water Integrity program.

Response
The Generic Letter 89-13 responses did not identify the piping exposed to raw water in the standby service water system. LRA Table 3.3.2-3 is revised to include piping in the standby service water system exposed to an environment of raw water, for which the Service Water Integrity Program is credited to manage the effects of aging. LRA Section B.1.40, Service Water Integrity Program, description is revised to include inspection of this piping. The LRA changes associated with the response to this RAI are included with the RAI B.1.40-4 response.

Question
RAI B.1.40-2 (Service Water Integrity)

Background
For the "preventive actions" program element, Section 4.11 of RBS-EP-15-00007 states that corrosion products are insignificant due to the water treatment for the normal service water system; therefore, periodic flushing was not identified as part of RBS' response to GL 89 13 and is not performed by the Service Water Integrity program. RBS' initial response, dated February 2, 1990, for GL 89-13 Action Item I discusses the need to verify flow in portions of infrequently used cooling loops in the service water system.

Several plant-specific condition reports (e.g., CR-RBS-2008-03885, CR RBS 2011 03700, CR-RBS-2011-08119, CR-RBS-2012-01217, CR-RBS-2014-05562, and CR-RBS-2017-01659) document high differential pressures across the normal service water inlet strainers to the service water cooling heat exchangers. CR-RBS-2012-01217 states that the preventive maintenance frequency to clean the strainers needs to be updated to prevent excessive clogging and that the debris found in the strainer appears to be mostly rust particles.

Issue
Based on the plant-specific condition reports over several years, periodic high differential pressures across strainers, with the debris in some instances consisting mostly of rust particles, indicates that more than a minimal amount of corrosion products exist in the system. In addition, the existence of a preventive maintenance activity to clean the strainer indicates that some level of fouling is ongoing in the system. It is not clear to the staff that corrosion products are insignificant due to the water treatment in the normal service water system. Consequently, flushing of infrequently used cooling loops may be warranted.

Request
Provide additional information to support the current Service Water Integrity program's lack of preventive actions, such as periodic flushing, based on the plant-specific condition reports over several years with high differential pressures across strainers in the system.

Response
Generic Letter 89-13 required for open-loop service water systems that sites implement and maintain an ongoing program of surveillance and control techniques to significantly reduce the incidence of flow blockage problems as a result of biofouling. The RBS normal service water system was originally an open-loop system using raw water. This configuration was modified to a closed-loop system using demineralized water in the early 1990s, which eliminated the biofouling and greatly reduced the corrosion rates of components in the normal service water system.

Because the normal service water system is in service during plant operation, the service water cooling heat exchanger inlet strainers screen a large volume of water. The strainers have small 3/32 inch diameter holes. Rust in the strainer debris may have been formed during operation prior to modification of the system configuration. Small amounts of this rust can occasionally be dislodged by flow and be collected as designed in the strainers. The strainers are routinely monitored for differential pressure, and operators back flush them as needed. The back flushing activity may not eliminate all trapped material, so the full margin to the alarm setpoint is sometimes not restored until the strainer is disassembled and cleaned. The discussion of strainer performance in the corrective actions of CR-RBS-2012-01217 stated that the strainer last required removal and cleaning in 2000. The buildup was gradual enough that the differential pressure across the strainers could be monitored and cleaning scheduled before there was an adverse impact on system performance. The gradual increases in strainer differential pressure documented in these condition reports does not represent a concern with the water chemistry control that would indicate a need for periodic flushing of infrequently used cooling loops.

The water quality of the closed-loop normal service water system is controlled to minimize scaling, corrosion, and biological fouling. This is accomplished by injecting chemicals, including a corrosion inhibitor and a biocide, into the system. Water treatment with dispersants maintains solids in solution, eliminating deposition onto metal surfaces. The service water surge tank has a nitrogen overpressure to prevent oxygen ingress. Biofouling organisms, corrosion products, debris and silt are insignificant due to the water treatment used in the system. The normal service water system is equipped with a corrosion coupon rack to monitor and trend corrosion rates of various system materials. The corrosion coupon rack is designed to simulate various piping and components in the system, operating at various flow rates and temperatures. The corrosion coupon monitoring results are all well within the limits established for the service water system and indicate good control of closed cooling water system chemistry. Therefore, periodic flushing of infrequently used cooling loops of this demineralized water system was not included in the RBS response to NRC GL 89-13 and is not necessary to manage the effects of aging on the RBS service water system.

Question
RAI B.1.40-3 (Service Water Integrity)

Background
With regard to the "parameters monitored or inspected" program element, LRA Table 3.3.2-3, "Service Water System," lists the standby cooling tower spray nozzles with an intended function only as pressure boundary; the aging effect requiring management only as loss of material; and the aging management program as Internal Surfaces in Miscellaneous Piping and Ducting Components. LRA Table 2.0-1 "Component Intended Functions: Abbreviations and Definitions," describes "flow control" as providing control of flow rate or establishing a pattern of spray, and "flow distribution" as providing distribution of flow. The service water system design criteria states that the returning service water is sprayed and cooled in the standby service water cooling tower. The LRA identifies the Internal Surfaces in Miscellaneous Piping and Ducting Components program as a new program (i.e., is not an existing program) and states that the program will be implemented prior to 2025.

Issue
Based on statements in the service water system design criteria (i.e., that the returning service water is sprayed and cooled in the standby service water cooling tower), the spray nozzles appear to have an intended function of either flow control or flow distribution. In response to questions during the program audit, RBS personnel stated that the nozzles have a large diameter opening to distribute the water over the fill [emphasis added]. As a result, it is unclear to the staff whether all intended functions of the spray nozzles have been identified. In addition, it is unclear to the staff whether aging affects requiring management of the spray nozzles should also include flow blockage due to fouling for the raw water environment. It is also unclear to the staff whether the spray nozzles, 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.

Request

For the standby cooling tower spray nozzles, provide additional information to clarify:

1. whether all intended functions of the spray nozzles have been identified,

2. whether aging affects requiring management also include flow blockage due to fouling for the raw water environment, and

3. whether spray nozzles are within the scope of GL 89-13 and consequently within the scope of the Service Water Integrity program.

Response

1. LRA Tables 2.3.3-3 and 3.3.2-3 are revised to add flow distribution as an intended function for the standby cooling tower nozzles. The Service Water Integrity Program is credited to manage loss of material for the internal environment of raw water.

2. The nozzles are part of the standby service water system, which is not normally in service. The nozzles have large-diameter openings (2½" x 2") that are not conducive to fouling. Therefore, flow blockage is not an aging effect requiring management.

3. The GL 89-13 responses did not identify the standby cooling tower nozzles. However, the description in LRA Section B.1.40, Service Water Integrity Program, is revised to indicate that inspection of the nozzles is part of the program.

The LRA changes are shown in the RAI B.1.40-4 response.

Question

RAI B.1.40-4 (Service Water Integrity)

Background

For the "detection of aging effects" program element, Section 4.11 of RBS EP 15 00007 states that nondestructive testing is periodically used to measure the extent of wall thinning associated with service water integrity components. Based on drawing 0232.530-087-007, Revision 300, "Piping Isometric," large portions of the horizontal carbon steel distribution piping for the standby service water cooling tower have standing water with an air-to-water interface. Based on industry operating experience in NRC Information Notice 2013 06, "Corrosion in Fire Protection Piping Due to Air and Water Interaction," this can lead to increased corrosion due to differential aeration at the air to water interface and corrosion product accumulation.

Issue

Based on the potential for increased 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 in portions of the service water distribution piping in the standby cooling tower.

Request

Provide additional information to show that program activities will adequately manage aging of the horizontal carbon steel piping in the standby service water cooling tower resulting from the increased potential for corrosion and corrosion product accumulation due to the air to water interface.

Response
The program will be enhanced to include inspection of horizontal service water distribution piping in the standby cooling tower at locations that have an air-to-water interface.

The LRA changes from the RAI B.1.40-1, -3 and -4 responses are included in the changes in this response. The changes to LRA Table 2.3.3-3, Table 3.3-1, Table 3.3.2-3, Section A.1.40, Appendix A.4, Table B-3, and Section B.1.40 follow with additions underlined and deletions lined through.

Change to LRA Table 2.3.3-3

Table 2.3.3-3
Service Water System
Components Subject to Aging Management Review

Component Type	Intended Function
Nozzle	Pressure boundary Flow distribution

Changes to LRA Table 3.3-1

Table 3.3.1: Auxiliary Systems

Item Number	Component	Aging Effect/ Mechanism	Aging Management Programs	Further Evaluation Recommended	Discussion
3.3.1-34	Nickel alloy, copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. ~~The portions of the RBS service water system covered by NRC GL 89-13 use closed cycle cooling water rather than raw water.~~ <u>Item 3.3.1-36 was used for the copper alloy nozzles.</u>
3.3.1-35	Copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. ~~The portions of the RBS service water system covered by NRC GL 89-13 use closed cycle cooling water rather than raw water.~~ <u>Item 3.3.1-36 was used for the copper alloy nozzles.</u>
3.3.1-36	Copper alloy piping, piping components, and piping elements exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	~~This item was not used. The portions of the RBS service water system covered by NRC GL 89-13 use closed cycle cooling water rather than raw water.~~ <u>The Service Water Integrity Program manages the effects of aging on copper alloy water distribution nozzles in the standby service water system.</u>
3.3.1-37	Steel piping, piping components, and piping elements exposed to raw water	Loss of material due to general, pitting, crevice, and microbiologically influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	~~This item was not used. The portions of the RBS service water system covered by NRC GL 89-13 use closed cycle cooling water rather than raw water.~~ <u>The Service Water Integrity Program manages the effects of aging on steel piping in the standby service water cooling tower.</u>

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-38	Copper alloy, steel heat exchanger components exposed to raw water	Loss of material due to general, pitting, crevice, galvanic, and microbiologically influenced corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. The heat exchangers ~~portions~~ of the RBS service water system covered by NRC GL 89-13 use closed cycle cooling water rather than raw water.
3.3.1-39	Stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. The portions of the RBS service water system containing these components covered by NRC GL 89-13 use closed cycle cooling water rather than raw water.
3.3.1-40	Stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting and crevice corrosion; fouling that leads to corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. The portions of the RBS service water system containing these components covered by NRC GL 89-13 use closed cycle cooling water rather than raw water.
3.3.1-41	Stainless steel piping, piping components, and piping elements exposed to raw water	Loss of material due to pitting, crevice, and microbiologically influenced corrosion	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	This item was not used. The portions of the RBS service water system containing these components covered by NRC GL 89-13 use closed cycle cooling water rather than raw water.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-42	Copper alloy, titanium, stainless steel heat exchanger tubes exposed to raw water	Reduction of heat transfer due to fouling	Chapter XI.M20, "Open-Cycle Cooling Water System"	No	The ~~portions~~ heat exchangers of the RBS service water system covered by NRC GL 89-13 use closed cycle cooling water rather than raw water. Reduction of heat transfer for stainless steel and copper alloy heat exchanger tubes in the fire protection system and portions of the service water system not covered by NRC GL 89-13 is managed by the Internal Surfaces in Miscellaneous Piping and Ducting Components Program. There are no titanium heat exchanger tubes exposed to raw water in the auxiliary systems in the scope of license renewal.

Changes to LRA Table 3.3.2-3

Table 3.3.2-3: Service Water System								
Component Type	**Intended Function**	**Material**	**Environment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Piping (in standby service water cooling tower)	Pressure boundary	Carbon steel	Raw water (int)	Loss of material	Service Water Integrity	VII.C1.AP-194	3.3.1-37	A
Piping (in standby service water cooling tower)	Pressure boundary	Carbon steel	Raw water (ext)	Loss of material	Service Water Integrity	VII.C1.AP-194	3.3.1-37	A

Nozzle	Pressure boundary Flow distribution	Copper alloy	Air – outdoor (ext)	Loss of material	External Surfaces Monitoring	VII.I.AP-159	3.3.1-81	A
Nozzle	Pressure boundary Flow distribution	Copper alloy	Raw water (int)	Loss of material	~~Internal Surfaces in Miscellaneous Piping and Ducting Components~~ Service Water Integrity	~~VII.C1.A-408~~ VII.C1.AP-196	~~3.3.1-134~~ 3.3.1-36	A

Changes to LRA Section A.1.40

The Service Water Integrity Program manages loss of material and reduction of heat transfer for service water system components fabricated from carbon steel, carbon steel with copper cladding, stainless steel, and copper alloy in an environment of treated water. The program includes periodic (a) testing of the RHR heat exchangers to verify heat transfer capability, (b) inspection and maintenance of the auxiliary building unit coolers, (c) routine maintenance (cleaning) of the RHR heat exchanger radiation monitor coolers, and (d) routine maintenance (cleaning) of the penetration valve leakage control system (PVLCS) compressor aftercoolers. The program includes inspecting the safety-related carbon steel piping in the standby service water cooling tower exposed to raw water. Inspections will include submerged piping and the distribution piping in the tower at locations with an air-to-water interface. The nozzles on the standby service water distribution piping are inspected. There are no internal coatings in components crediting the Service Water Integrity Program for managing the effects of aging.

The Service Water Integrity Program will be enhanced as follows.

- Revise Service Water Integrity Program documents to inspect the safety-related carbon steel piping in the standby service water cooling tower exposed to raw water. Inspections will include visual inspection of accessible submerged piping at least once every 10 years. Five volumetric inspections per 10-year period of the period of extended operation will be performed to determine wall thickness of the horizontal distribution piping in the tower at locations with an air-to-water interface.

Enhancements will be implemented prior to the period of extended operation.

Addition to Commitment List (Appendix A.4)

31	Service Water Integrity	Enhance the Service Water Integrity Program as described in LRA Section A.1.40.	Prior to February 28, 2025.	RBG-47834

Changes to Table B-3

Program Name	Plant-Specific	NUREG-1801 Comparison: Program has Enhancements	NUREG-1801 Comparison: Program has Exceptions to NUREG-1801
Service Water Integrity [B.1.40]		X	

Changes to LRA B.1.40

B.1.40 SERVICE WATER INTEGRITY

Program Description

The Service Water Integrity Program manages loss of material and reduction of heat transfer for service water system components fabricated from carbon steel, carbon steel with copper cladding, stainless steel, and copper alloy in an environment of treated water.

The program includes periodic (a) testing of the RHR heat exchangers to verify heat transfer capability, (b) inspection and maintenance of the auxiliary building unit coolers, (c) routine maintenance (cleaning) of the RHR heat exchanger radiation monitor coolers, and (d) routine maintenance (cleaning) of the penetration valve leakage control system (PVLCS) compressor aftercoolers. The program includes inspecting the safety-related carbon steel piping in the standby service water cooling tower exposed to raw water. Inspections will include submerged piping and the horizontal distribution piping in the tower at locations with an air-to-water interface. The nozzles on the standby service water distribution piping are inspected. There are no internal coatings in components crediting the Service Water Integrity Program for managing the effects of aging.

NUREG-1801 Consistency

The Service Water Integrity Program, with an enhancement, is consistent with the program described in NUREG-1801, Section 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."

Exceptions to NUREG-1801

None

Enhancements

The following enhancement will be implemented prior to the period of extended operation.

Element Affected	Enhancement
4. Detection of Aging Effects	Revise Service Water Integrity Program documents to inspect the safety-related carbon steel piping in the standby service water cooling tower exposed to raw water. Inspections will include visual inspection of accessible submerged piping at least once every 10 years. Five volumetric inspections per 10-year period of the period of extended operation will be performed to determine wall thickness of the horizontal distribution piping in the tower at locations with an air-to-water interface.

Question
RAI B.1.40-5 (Service Water Integrity)

Background
LRA Table 3.5.2-2, "Water-Control Structures," indicates that the cooling tower tile fill for both the standby service water and the service water cooling systems do not have aging affects requiring management and, consequently, do not need an aging management program. Plant-specific operating experience report CR-RBS-2008-05043 discusses broken pieces of cooling tower fill material in the collector pots of the circulating water system. During the aging management program audit, RBS personnel stated that the circulating water system cooling tower fill is similar to the standby service water fill material in LRA Table 3.5.2-2. In addition, CR-RBS-2006-03376 discusses the failure of the fill material support members in the service water cooling system cooling tower Cell D that resulted in approximately 30 percent of the fill material falling into the associated cooling tower basin. According to the condition report, a contributing factor of the failure was an overload condition caused by fouling of the fill material. Several corrective actions from this condition report included the development of a periodic fill inspection program.

Issue
Based on plant-specific operating experience reports CR-RBS-2006-03376 and CR-RBS-2008-05043, documenting degradation of the fill material (either cracking or fouling that leads to an increase in weight), it is not clear to the staff why there are no aging effects requiring management for the fill material in the cooling towers for the standby service water and service water cooling systems.

Request
Given the plant-specific operating experience described in CR-RBS-2006-03376 and CR-RBS-2008-05043, associated with the fill material in the cooling towers, state the basis for why there are no applicable aging effects. Alternatively, state how the LRA will be revised to address the applicable aging effects.

Response
The cooling tower fill material identified in CR-RBS-2008-05043 is associated with the circulating water cooling towers, which are not subject to aging management review.

The service water cooling system (SWC) cooling tower fill material is the subject of condition report CR-RBS-2006-03376. The cause of the fill material failure was not the effects of aging, but was a less than adequate design of the fill support systems. The failure was not in the fill material. According to the apparent cause evaluation, the fill fell due to failure of the fiber-reinforced plastic (FRP) bearing plate supporting the fill support beam. This bearing plate design has been replaced with a stainless steel design. Additionally, a thicker FRP support beam design was incorporated into the fill support system.

A contributing cause identified in the evaluation under CR-RBS-2006-03376 was an increase in the weight of the fill material due to fouling. However, the increased weight would not have caused the failure if the fill support system design had been adequate. Nevertheless, River Bend Station license renewal application Section 3.5.2.1.2 and Table 3.5.2-2 are revised to show fouling as an aging effect for fill material and to indicate that the Structures Monitoring Program will manage the aging effect.

Because the fill material condition remained acceptable following the failure, no additional aging effects requiring management have been identified for the fill material identified in LRA Table 3.5.2-2.

LRA revisions follow. Additions are underlined and deletions are lined through.

3.5.2.1.2 Water-Control Structures

Aging Effects Requiring Management

The following aging effects associated with water-control structure components require management.

- Cracking
- Cracking and distortion
- Fouling
- Increase in porosity and permeability
- Loss of bond
- Loss of material
- Loss of strength

Table 3.5.2-2: Water-Control Structures

Structure and/or Component or Commodity	Intended Function	Material	Environment	Aging Effect Requiring Management	Aging Management Program	NUREG-1801 Item	Table 1 Item	Notes
Cooling tower tile fill (SSW ~~and SWC~~ cooling tower)	HS, SNS	Ceramic and clay tile	Exposed to fluid environment	~~None~~ Fouling	~~None~~ Structures Monitoring	--	--	J
Cooling tower tile fill (~~SSW and~~ SWC cooling tower)	HS, SNS	Polyvinyl chloride	Exposed to fluid environment	~~None~~ Fouling	~~None~~ Structures Monitoring	--	--	J

Question

RAI B.1.43-1 (Closed Treated Water Systems)

Background

In support of its integrated plant assessment, River Bend Station (RBS) prepared report RBS-EP-15-00007, Revision 0, "Aging Management Program Evaluation Results – Non Class 1 Mechanical," to demonstrate that the programs credited in the license renewal aging management review reports are adequate to support license renewal. The RBS report states that it identifies the applicable program procedures and controlling documentation and describes the program elements required to support the RBS license renewal application. For the "parameters monitored or inspected" program element, RBS-EP-15-00007 Section 4.13, "Water Chemistry Control – Closed Treated Water Systems," states that the chemical parameter limits and action levels are stated in the "River Bend Station Closed Cooling Water Systems Strategic Plan" and that the program's established standards are consistent with EPRI 1007820, "Closed Cooling Water Chemistry Guideline." The report also states this program element is consistent with the GALL Report AMP XI.M21A. The corresponding portion of the GALL Report AMP XI.M21A states that EPRI 1007820 is used for closed-cycle cooling water systems defined in NRC Generic Letter 89-13, "Service Water System Problems Affecting Safety-

Related Equipment," and that in all cases the selected industry standard is used in its entirety.

Issue
The "River Bend Station Closed Cooling Water Systems Strategic Plan" includes Appendix 1, "Justification for the Deviations from EPRI CCW Guidance," which documents inconsistencies with EPRI 1007820 for various parameters in seven systems. In addition, in the strategic plan table for "Diesel Jacket Water System Surveillance and Monitoring," the values of the C1 and C2 action levels for pH are inconsistent with the corresponding values in EPRI 1007828, and these deviations are not addressed in the Appendix 1 discussions. It is unclear to the staff that the Water Chemistry Control – Closed Treated Water Systems program was consistent with the "parameters monitored or inspected" program element of the GALL Report AMP XI.M21A.

Request
Based on the apparent inconsistencies discussed above, provide additional information to show that the Water Chemistry Control – Closed Treated Water Systems program is consistent with the "parameters monitored or inspected" program element of the GALL Report AMP XI.M21A.

Response
EPRI 1007820, Closed Cooling Water Chemistry Guideline, states that deviating from the specifications outlined in the guideline, with the understanding and approval of plant management, is allowed - provided that sound technical justification and/or performance monitoring supports the deviation. Therefore, an approved and justified deviation is not inconsistent with the EPRI guideline and does not constitute an exception to the program described in NUREG-1801 Section XI.M21A.

In the RBS Closed Cooling Water Systems Strategic Plan Appendix 1, "Justification for the Deviations from EPRI CCW Guidance," RBS personnel inadvertently omitted the justification for standby diesel generator jacket cooling water systems pH action levels C1 and C2 deviating from the corresponding values in EPRI 1007820. This condition has been entered into the Corrective Action Program to revise the pH values for the standby diesel generator jacket cooling water systems to be consistent with the pH values in EPRI 1007820 or to provide justification for any deviation in accordance with the provisions of EPRI 1007820.

Question
RAI B.1.43-2 (Closed Treated Water Systems)

Background
For the "detection of aging effects" program element, Section 4.13 of RBS-EP-15-00007 states that the Water Chemistry – Closed Treated Water Systems program manages the effects of aging in an environment of treated water. For the vacuum release accumulators in LRA Table 3.3.2-3 (TK1A and TK1B on drawing PID-09-10F), the internal environment is listed as treated water with the aging management program listed as Water Chemistry Control – Closed Treated Water Systems.

Issue
Based on the information shown on drawing PID-09-10F, "System 118 Service Water Normal," the accumulators and portions of the associated piping do not appear to have an internal environment of treated water because these components are supplied by the compressed air system. It is not clear to the staff whether these components have a treated water internal environment and whether the aging affects for these components will be managed by the Water Chemistry Control – Closed Treated Water Systems program as listed in LRA Table 3.3.2-3.

In addition, based on information in Standby Service Water Quarterly Valve Operability Test procedures (STP-256-6305 and STP-256-6306 for valves SOV-522A, B, C, D and SOV-523A, B, C, D), air is periodically introduced into portions of the piping as part of the vacuum release solenoid valve function verification. Based on the piping configurations in various isometric drawings, it appears that air cannot be vented in some portions of the associated piping, between the check valves and the treated water source. Consequently, there will be an air water interface in a portion of the pipe, with the air being periodically replenished, similar to the situation in NRC Information Notice 2013 06, "Corrosion in Fire Protection Piping Due to Air and Water Interaction." It is not clear to the staff that the Water Chemistry Control – Closed Treated Water Systems program activities account for this situation.

Request

1. Clarify the information provided in LRA Table 3.3.2-3 (TK1A and TK1B on drawing PID-09-10F), with regard to the internal environment of the vacuum release accumulators and portions of the associated piping, and whether aging effects of these components will be managed by the Water Chemistry Control – Closed Treated Water Systems program.

2. Provide additional information to show that the activities in the Water Chemistry Control – Closed Treated Water Systems adequately account for the potential air-water interface in the portions of the piping that cannot be vented between the check valves and the treated water source (associated with SOV-522A, B, C, D, and SOV 523A, B, C, D).

Response

1. LRA Table 3.3.2-3 vacuum release accumulators (TK1A and TK1B on drawing PID-09-10F) contain instrument air. The LRA is revised to identify that the Compressed Air Monitoring Program manages the aging effects for the internal surfaces of the vacuum release accumulators and associated piping.

2. Normally closed SOV-522A, B, C, and D are located downstream of the two instrument air accumulators. If necessary, the service water system in the containment relies on this instrument air to release a vacuum in the system piping.

   Normally closed SOV-523A, B, C, and D are not associated with accumulators containing instrument air. If necessary to release system vacuum, the valves open to admit air from the auxiliary building into the service water system.

   The RAI Issue discussion refers to NRC Information Notice 2013-06, "Corrosion in Fire Protection Piping Due to Air and Water Interaction". This information notice discusses fire water systems which may contain highly oxygenated, raw, untreated water. The RBS service water system contains demineralized water treated with sodium nitrite and molybdate as corrosion inhibitors. Because of this piping internal environment, significant corrosion is not expected.

   To confirm the insignificance of corrosion in the subject piping, inspections will verify that unacceptable degradation is not occurring. For the portions of the containment piping that cannot be vented between the check valves and the treated water source, the One-Time Inspection Program will perform a volumetric inspection of a piping segment associated with SOV-522A, B, C, or D.

For the portions of the auxiliary building piping that cannot be vented between the check valves and the treated water source, the One-Time Inspection Program will perform a volumetric inspection of a piping segment associated with SOV-523A, B, C, or D.

The changes to LRA Table 3.3.2-3 and the associated notes, Table 3.3.1, Section A.1.32, and B.1.32 follow with additions underlined.

Table 3.3.2-3: Service Water System								
Component Type	**Intended Function**	**Material**	**Environ-ment**	**Aging Effect Requiring Management**	**Aging Management Programs**	**NUREG-1801 Item**	**Table 1 Item**	**Notes**
Accumulator	Pressure boundary	Carbon steel	Condens ation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	B
Piping	Pressure boundary	Carbon steel	Condens-ation (int)	Loss of material	Compressed Air Monitoring	VII.D.A-26	3.3.1-55	B
Piping	Pressure boundary	Carbon steel	Treated water (int)	Loss of material	One-Time Inspection	VII.C2.AP-202	3.3.1-45	A, 309

Notes for Tables 3.3.2-1 through 3.3.2-18-26

Plant-Specific Notes

309.The One-Time Inspection Program will confirm the insignificance of corrosion for service water system containment and auxiliary building vacuum release piping that may have an air/water interface. The One-Time Inspection Program will use NDE techniques to inspect this piping for loss of material.

Table 3.3.1: Auxiliary Systems					
Item Number	**Component**	**Aging Effect/ Mechanism**	**Aging Management Programs**	**Further Evaluation Recommended**	**Discussion**
3.3.1-45	Steel piping, piping components, and piping elements; tanks exposed to closed-cycle cooling water	Loss of material due to general, pitting, and crevice corrosion	Chapter XI.M21A, "Closed Treated Water Systems"	No	Consistent with NUREG-1801. Loss of material for steel components exposed to closed-cycle cooling water is managed by the Water Chemistry Control – Closed Treated Water Systems Program. The One-Time Inspection Program will confirm the insignificance of corrosion for service water system containment and auxiliary building vacuum release piping that may have an air/water interface. The One-Time Inspection Program will use NDE techniques to inspect this piping for loss of material.

A.1.32 One-Time Inspection

The program will include activities to verify effectiveness of aging management programs and activities to confirm the insignificance of aging effects as described below.

A representative sample of service water system containment and auxiliary building vacuum release piping that cannot be vented between the check valves and the treated water source.	One-time inspection will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.

Inspections will be performed within the 10 years prior to the period of extended operation.

B.1.32 One-Time Inspection

The program will include activities to verify effectiveness of aging management programs and activities to confirm the insignificance of aging effects as described below.

A representative sample of service water system containment and auxiliary building vacuum release piping that cannot be vented between the check valves and the treated water source.	One-time inspection will confirm that loss of material is not occurring or is occurring so slowly that the aging effect will not affect the component intended function during the period of extended operation.

Inspections will be performed within the 10 years prior to the period of extended operation.

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Enclosure 2

Commitment

This table identifies actions discussed in this letter that Entergy commits to perform. Any other actions discussed in this submittal are described for the NRC's information and are **not** commitments.

Changes to LRA Section A.4 follow with additions underlined

Addition to Commitment List (Appendix A.4)

31	Service Water Integrity	Enhance the Service Water Integrity Program as described in LRA Section A.1.40.	Prior to February 28, 2025.	RBG-47834