NRR-DMPSPEm Resource

From:	Wong, Albert
Sent:	Monday, April 30, 2018 9:24 AM
To:	Mr. William F. Maguire
Cc:	RidsNrrDmlr Resource; RidsNrrDmlrMrpb Resource; RidsNrrPMRiverBend Resource; RidsOgcMailCenter Resource; Wilson, George; Donoghue, Joseph; Sayoc, Emmanuel; Wong, Albert; Mink, Aaron; Medoff, James; Sadollah, Mohammad; Nguyen, Duc; Oesterle, Eric; Alley, David; Martinez Navedo, Tania; Bailey, Stewart; Wittick, Brian; Ruffin, Steve; Bloom, Steven; Regner, Lisa; Turk, Sherwin; Sowa, Jeffrey; Parks, Brian; Pick, Greg; Kozal, Jason; Young, Cale; Young, Matt; Werner, Greg; McIntyre, David; Dricks, Victor; Moreno, Angel; Burnell, Scott; 'Broussard, Thomas Ray'; Lach, David J; SCHENK, TIMOTHY A; 'Coates, Alyson'; Pereira, Dennis; Otto, Ngola
Subject:	FINAL REQUESTS FOR ADDITIONAL INFORMATION FOR THE SAFETY REVIEW OF THE RIVER BEND STATION LICENSE RENEWAL APPLICATION (CAC NO. MF9757) – SET 14
Attachments:	Set 14 RAIs Attachment 1 Chronology of the RAIs.pdf; Set 14 RAIs Enclosure - Followed-up RAIs_3.6.2.2.2-1a, 4.3.1-2a & 4.7.3-1a.pdf

Docket No. 50-458

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 pursuant to Title 10 of the *Code of Federal Regulations* Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants," to renew the operating license NPF-47 for River Bend Station.

On April 18, 2018, the U.S Nuclear Regulatory Commission (NRC) staff held a public telephone call with the Entergy Operations, Inc. staff to discuss the applicant's response to various Requests for Additional Information (RAIs). The specific dates of the original RAIs and the applicant's responses in Attachment 1. The final RAIs are enclosed.

David Lach of your staff agreed to provide a response to all the final RAIs within 30 days of the date of this email. The NRC staff will be placing a copy of this email in the NRC's Agencywide Documents Access and Management System.

Sincerely,

Emmanuel Sayoc, Project Manager *Albert Wong for*
License Renewal Projects Branch (MRPB)
Division of Materials and License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-458

Enclosure:
As stated

OFFICE	PM:MRPB:DMLR	BC: MRPB:DMLR	PM: MRPB:DMLR
NAME	ESayoc	EOesterle	ESayoc *Albert Wong for*
DATE	04/26/2018	04/27/2018	04/30/2018

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Subject: FINAL REQUESTS FOR ADDITIONAL INFORMATION FOR THE SAFETY REVIEW OF THE RIVER BEND STATION LICENSE RENEWAL APPLICATION (CAC NO. MF9757) – SET 14
Sent Date: 4/30/2018 9:23:57 AM
Received Date: 4/30/2018 9:23:00 AM
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Files	**Size**	**Date & Time**
MESSAGE	1449	4/30/2018 9:23:00 AM
Set 14 RAIs Attachment 1 Chronology of the RAIs.pdf	75923	
Set 14 RAIs Enclosure - Followed-up RAIs_3.6.2.2.2-1a, 4.3.1-2a & 4.7.3-1a.pdf	117190	

Options

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ATTACHMENT 1 CHRONOLOGY OF THE RAIS AND THE APPLICANT'S RESPONSES

ORIGINAL RAI#	RAI Set #	Date of the Original RAI Issued	Date of Applicant's Response
3.6.2.2.2-1 High Voltage Insulators	8	January 22, 2018 (ML18022A941)	February 20, 2018 (ML18051A531)
4.3.1-2 Class 1 Fatigue	10	February 8, 2018 (ML18043A008)	March 26, 2018 (ML18087A188)
4.7.3-1 Fluence Effect for Reactor Vessel Internals	10	February 8, 2018 (ML18043A008)	March 26, 2018 (ML18087A188)

Regulatory Basis

10 CFR § 54.21(a)(3) of 10 CFR requires an applicant to demonstrate that the effects of aging for structures and components will be adequately managed so that the intended function(s) will be maintained consistent with the current licensing basis for the period of extended operation. One of the findings that the staff must make to issue a renewed license (10 CFR § 54.29(a)) is that actions have been identified and have been or will be taken with respect to the managing the effects of aging during the period of extended operation on the functionality of structures and components that have been identified to require review under § 54.21, such that there is reasonable assurance that the activities authorized by the renewed license will continue to be conducted in accordance with the current licensing basis (CLB). As described in SRP LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL Report. In order to complete its review and enable making a finding under 10 CFR § 54.29(a), the staff requires additional information in regard to the matters described below.

RAI 3.6.2.2.2-1a (High Voltage Insulators)

LRA 3.6.2.2.2 Degradation of Insulator Quality due to Presence of Any Salt Deposits and Surface Contamination, and Loss of Material due to Mechanical Wear

Background - In LRA 3.6.2.2.2, the applicant references SRP-LR for further evaluation of the above aging mechanisms and effects for high-voltage insulators. Table 3.6.1, line item numbers 3.6.1-2 and 3.6.1-3 identify the component as: "High voltage insulators composed of porcelain, malleable iron, aluminum, galvanized steel and cement." The corresponding items in Table 3.6.2 of the LRA identify the material as: "Porcelain, galvanized metal and cement."

During the onsite audit/walkdown, the staff noted that in-scope high-voltage insulators on the 230 kV transmission lines are constructed of polymer material rather than the porcelain material listed in LRA Table 3.6.1 and Table 3.6.2. The applicant stated that the porcelain insulators had been replaced with new insulators made of polymeric material in 2008. The actual material (polymer) used in construction of the existing in-scope high-voltage insulators are not identified in the applicant's LRA.

Staff issued RAI 3.6.2.2.2-1 to obtain clarification on why the LRA did not address the replacement components, and aging effects related to polymer high-voltage insulators. The RAI and the applicant's response is documented in ADAMS Accession No. ML 18051A531, dated February 20, 2018. In its response the applicant provided update to the LRA section 3.6.2.1 as well as adding a new line item to AMR table 3.6.2 for polymer high-voltage insulators. The applicant also provided written further evaluation discussions in response to RAI 2.6.2.2.2-1 for these components and concluded that there are no aging effects requiring management and did not propose a site-specific aging management program.

The staff's review of the RAI response as well as industry literature, vendor documents, RBS procedures and work orders identified some material used in the construction of the polymer high-voltage insulators that were not listed in the applicant's proposed changes to the LRA. Specifically, according to vendor and industry literature provided by the applicant, the missing material include: epoxy, silicone gel, sealants, and ductile iron.

The staff's review of the RAI response and relevant technical information provided by the applicant further identified pertinent aging effects and mechanisms not addressed in the applicant's response. These include:

- Stress corrosion cracking of glass fibers
- Swelling of silicone rubber (SIR) layer due to chemical contamination
- Sheath wetting caused by chemicals absorbed by oil from SIR compound
- Brittle fracture of rods resulting from discharge activity, flashunder, and flashover
- Chalking and crazing of insulator surfaces resulting in contamination, arcing, and flashover
- Bonding failure at rod and sheathing interface
- Water ingress through end fittings causing corrosion and fracture of glass fibers

The staff also noted that rodents and birds excrements containing aggressive chemicals such as phosphates, uric acid, and ammonia create an environment that can cause sheath layer damage and subsequent failures of the core material and fittings. Susceptibility of these components to this environment, which has not been reviewed in GALL needs to be addressed.

According to research results, aging studies and handbook material provided by the applicant, polymer insulators have been shown to have unique failure modes with little advance indications. This information also indicates that contamination can be worse for SIR (compared to porcelain insulators) due to absorption by silicone oil, especially in late stages of service life.

The staff and representatives of the applicant held a public telephone conference call on April 18, 2018, to discuss the applicant's responses to RAI 3.6.2.2.2.2-1 and issues outlined below.

Issues -

1. The material listed in the applicant's response to RAI 3.6.2.2.2-1 seems to have eliminated certain material that are used in construction of the polymer insulators. According to vendor literature and industry reports, these include: epoxy, silicone gel, sealants, and ductile iron.
2. The aging effects and mechanisms addressed in the applicant's response to RAI 3.6.2.2.2-1 seem to have addressed some, but not all relevant aging effects requiring management (AERM). The AERMs not considered in the response include the following:
    a. Stress corrosion cracking (SCC) of glass fibers due to sheath degradation
    b. Swelling of SIR layer due to chemical contamination
    c. Sheath wetting caused by chemicals absorbed by oil from SIR compound
    d. Brittle fracture of rods resulting from discharge activity, flashunder, and flashover
    e. Chalking and crazing of insulator surfaces resulting in contamination, arcing, and flashover
    f. Water penetration through the sheath followed by electrical failure
    g. Bonding failure at rod and sheathing interface
    h. Water ingress through end fittings causing corrosion and fracture of glass fibers
3. Additionally, aggressive environment due to excrements from birds and rodents containing chemicals such as uric acid, phosphates, and ammonia that can accelerate degradation of polymers is not addressed in the applicant's response to RAI 3.6.2.2.2-1 as a site-specific condition. This environment and material combination has not

previously been evaluated in the GALL Report and constitutes a site-specific condition to be assessed for RBS.

4. The applicant concluded, in its response to RAI 3.6.2.2.2-1, that an aging management program will not be implemented for polymer high-voltage insulators. The staff noted that polymer insulators have shown to have unique failure modes with little advance indications. Furthermore, contamination buildup can be worse for SIR (compared to porcelain insulators) due to absorption by silicone oil, especially in late stages of service life. It appears that the applicant's conclusion is based on the assumption that polymer insulators are more reliable than porcelain and less likely to be affected by aging degradation, primarily due to the hydrophobic characteristics of the polymers and reduced possibility of chemicals and particulate matter buildup on the surfaces of the insulators. The staff notes that the licensee's response does not include consideration of new and unique degradation mechanisms and sensitivity to the environment, especially during later stages of service life, typically past the twenty year period. It is not clear to the staff whether the applicant's conclusion considers all aspects of polymer insulators' degradation, aging, and failure mechanisms that may require aging management.

Request –

1. Explain why epoxy, silicone gel, sealants, and ductile iron are not listed in the response to RAI 3.6.2.2.2-1 as material that are used in construction of polymer high-voltage insulators.
2. Explain why certain aging effects and mechanisms that have been identified for polymer high-voltage insulators, by industry as a result of operating experience reviews and aging study research, have not been considered in response to RAI 3.6.2.2.2-1. These aging effects and mechanisms are listed above under the heading "Issues," items 2 (a) through (h).
3. Explain why aggressive environment due to excrements from birds and rodents containing chemicals such as uric acid, phosphates, and ammonia that can accelerate degradation of polymers has not been addressed in the response to RAI 3.6.2.2.2-1 as a site-specific environment. This environment and material combination has not previously been evaluated in the GALL Report and constitutes a site-specific condition to be assessed for RBS.
4. Explain whether the conclusions in response to RAI 3.6.2.2.2-1, that an aging management program is not needed, considers polymer insulators' degradation, aging, and failure mechanisms that may require monitoring, inspection, corrective actions, and aging management. Provide a discussion of operating experience, surface buildup of contaminations, susceptibility of contaminant absorption by silicone oil, reduced insulation resistance due to polymer degradation, tracking, corona, chalking and crazing of insulation surfaces, loosening of sheath layers, degradation of core fiber glass due to water intrusion, SCC of fiber glass material, wetting and swelling of SIR, bonding failure at rod/sheath interface, accelerated aging of polymer material due to discharge current activity and corona, aging studies, and any site-specific aging management program needed to ensure that the aging effects for these components composed of polymers, epoxy, silicone gel, sealants, and ductile iron will be adequately managed. Describe what parameters will be monitored or inspected to detect the AERM and how the frequency of inspection will be established. If no program will be used, justify why loss

of material, reduced insulation resistance, presence of deposits, rod fiber glass degradation, SCC of fiber glass material, wetting and swelling of SIR, accelerated aging of polymer material due to discharge current activity and corona, chalking and crazing of surfaces, tracking, corona, loosening of sheath layers, bonding failure at rod/sheath interface, separation of seals and sealants, water ingress through end fittings, and surface contamination are not applicable for the polymer high-voltage insulators exposed to air-outdoor and chemicals such as uric acid, phosphates and ammonia from birds and rodents.

Regulatory Basis for Follow-up RAIs on Fatigue TLAAs

The regulation in 10 CFR 54.21(c)(1) requires the applicant to provide an evaluation of each analysis conforming to the definition of a time-limited aging analysis (TLAA) in 10 CFR 54.3(a) and to demonstrate that the TLAA is acceptable in accordance with one or more of three TLAA disposition bases stated in the §54.21(c)(1) requirement:

(i) demonstration that the TLAA remains valid for the period of extended operation;
(ii) demonstration that the TLAA has been projected to the end of the period of extended operation; or
(iii) demonstration that the effects of aging (associated with the TLAA) on the intended function(s) of the component(s) will be adequately managed during the period of extended operation.

RAI 4.3.1-2a (Class 1 Fatigue)

Background - By letter dated March 26, 2018 (ADAMS ML18087A188), Entergy Operations Inc. (Entergy, or the applicant) submitted it response to RAI 4.3.1-1. In this response, the applicant identified the specific reactor vessel internal (RVI) components that were analyzed with a time-dependent cumulative usage factor (CUF) analysis in the current licensing basis (CLB) and provided the specific EPRI BWRVIP inspection and evaluation (I&E) reports that applied to the components.

Issue - The staff has been able to verify that the collective set of BWRVIP I&E reports referenced in the RAI response include inspection of all RVI component or component assemblies with CUF analyses in the CLB, with the exception of the core plate and core plate stiffener beams in the RVI design. Specifically, the EPRI I&E methodology in BWRVIP-25 does not include inspections of BWR-6 designed core plate assembly components because the core plate assemblies in these types of BWRs rely on structural wedges for maintaining the core plates in place during postulated design basis loading conditions and events. As a result, the applicant's use of BWRVIP-25 does not demonstrate that fatigue of core plate and core plate stiffener beams will be adequately managed during the period of extended operation in accordance with 10 CFR 54.21(c)(1)(iii).

Request - Justify that BWRVIP-25 is appropriate and adequate to manage fatigue of the core plate and core plate stiffener beams even though this document does not include inspections of these components.

Otherwise, provide an alternative program or alternate basis for dispositioning the CUF analyses of the core plate and core plate stiffener beams. Justify the basis selected to disposition the CUF analyses of the components in accordance with 10 CFR 54.21(c)(1)(i), (ii) or (iii).

RAI 4.7.3-1a (Fluence Effects for Reactor Vessel Internals)

Background - SRP-LR Section 4.7.3.1.2 states that for a TLAA disposition pursuant to 10 CFR 54.21(c)(1)(ii), the applicant shall provide a sufficient description of the analysis and document the results of the reanalysis to show that it is satisfactory for the 60-year period.

By letter dated March 26, 2018 (ADAMS ML18087A188), applicant submitted it responses to numerous RAIs (including 4.7.3-1 and 4.7.3-2). In its responses to RAI 4.7.3-2 and part 4 of RAI 4.7.3-1, the applicant provided a summary of the fluence projections for the various core support structure (CSS) components. The applicant stated that components that were projected to remain within the fluence thresholds do not require consideration beyond meeting the American Society of Mechanical Engineers Code requirements.

Additionally, the applicant indicated that the neutron fluence values for several of the CSS components have been projected to exceed the fluence criteria, and that these components must be evaluated to determine whether they meet the additional criteria that are required to be assessed by the CSS design specification.

Issue - For RVI components and welds that have been projected to exceed the fluence threshold values, the applicant has not described the design basis methodology used to determine whether these components and welds would meet the additional criteria of the CSS design specification. Additionally, the applicant did not identify the additional criteria (e.g., acceptance limits for the strain or weld quality factor parameters requiring assessment) that the components and welds need to meet or provide the component-specific and weld-specific results of the additional analyses, as compared to the additional criteria, to demonstrate that those criteria are met.

Request - Provide the following additional information for each CSS base metal or weld component that has been projected to exceed the fluence threshold value for the component at the end of the period of extended operation.

1. Describe the design specification methodology that applies to each component and identify the additional design parameter or parameters required to be assessed by the design specification.
2. Provide the acceptance limits or acceptance criteria that apply to the component design parameters requiring further assessment.
3. Provide the calculated component-specific values for the parameters requiring further assessment by the design specification, as assessed for or projected through the end of the period of extended operation.