NRR-DMPSPEm Resource

From: Sayoc, Emmanuel
Sent: Thursday, May 3, 2018 1:02 PM
To: Mr. William F. Maguire
Cc: RidsNrrDmlr Resource; RidsNrrDmlrMrpb Resource; RidsNrrPMRiverBend Resource; RidsOgcMailCenter Resource; Wilson, George; Donoghue, Joseph; Sadollah, Mohammad; Nguyen, Duc; Oesterle, Eric; Martinez Navedo, Tania; Regner, Lisa; Turk, Sherwin; Sowa, Jeffrey; 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; COX, ALAN B; Wong, Albert
Subject: FINAL REQUESTS FOR ADDITIONAL INFORMATION FOR THE SAFETY REVIEW OF THE RIVER BEND STATION LICENSE RENEWAL APPLICATION (CAC NO. MF9757) – SET 15
Attachments: 080 RBS AMR Follow Up RAI3.6.2.2.2-1a High Volt Insulators FINAL.pdf

Importance: High

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. (Entergy) 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.

By letter dated January 22, 2018 (ADAMS Accession No. ML18022A941) the U.S Nuclear Regulatory Commission (NRC) staff issued Request for Additional Information (RAI) 3.6.2.2.2-1 on High Voltage Insulators. Entergy responded with letter dated February 20, 2018 (ADAMS Accession No. ML18051A531). The staff reviewed the response and on April 18, 2018, the NRC staff held a public telephone call with the Entergy Operations, Inc. staff to discuss Entergy's response to various RAIs, including this RAI on High Voltage Insulators

On April 26, 2018 the NRC staff sent to Entergy a draft copy of a follow up RAI 3.6.2.2.2-1a on High Voltage Insulators. On May 1, 2018 the NRC staff held a clarification telephone call with the Entergy to discuss the follow up RAI 3.6.2.2.2-1a. The final RAI resulting from the clarification call is attached.

This RAI 3.6.2.2.2-1a issuance supersedes an earlier RAI issuance sent to Entergy on April 30, 2018.

Alan Cox of your staff agreed to provide a response to this RAI within 30 days of the May 1, 2018 clarification call. 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
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
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DATE	05/03/2018	05/03/2018	05/03/2018

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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 15
Sent Date: 5/3/2018 1:02:07 PM
Received Date: 5/3/2018 1:02:00 PM
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MESSAGE	2010	5/3/2018 1:02:00 PM	
080 RBS AMR Follow Up RAI3.6.2.2.2-1a High Volt Insulators FINAL.pdf			74956

Options

Priority:	High
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RAI 3.6.2.2.2-1a (TRP 80 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

Regulatory Basis

Section 54.21(a)(1) of 10 CFR requires the applicant to identify and list those structures and components subject to an aging management review. Section 54.21(a)(3) of 10 CFR requires the applicant to demonstrate that the effects of aging for structures and components within the scope of license renewal and subject to an AMR pursuant to 10 CFR 54.21(a)(1) 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. As described in SRP-LR, an applicant may demonstrate compliance with 10 CFR 54.21(a)(3) by referencing the GALL Report when evaluation of the matter in the GALL Report applies to the plant.

Section 3.6.2.2.2 of SRP-LR, "Reduced Insulation Resistance due to Presence of Any Salt Deposits and Surface Contamination, and Loss of Material due to Mechanical Wear Caused by Wind Blowing on Transmission Conductors" states that: "Loss of material due to mechanical wear caused by wind blowing on transmission conductors could occur in high-voltage insulators. The GALL Report recommends further evaluation of a plant-specific AMP to ensure that this aging effect is adequately managed." The GALL report also recommends further evaluation of plant-specific AMP for potential salt deposits and surface contamination.

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 materials 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 polymer in-scope high-voltage insulators was 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 are documented in ADAMS Accession No. ML 18051A531, dated February 20, 2018. In its response, the applicant provided update to 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 further evaluation discussions in response to RAI 3.6.2.2.2-1 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 materials used in the construction of the polymer high-voltage insulators that were not listed in the applicant's changes to the LRA. Specifically, according to vendor and EPRI literature provided by the applicant, the missing materials 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 flashunder, corrosion and fracture of glass fibers

The staff also noted that rodent and bird excrement 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.

<u>Issues</u>

1- The materials listed in the applicant's response to RAI 3.6.2.2.2-1 seems to have omitted certain materials that are used in construction of the polymer insulators. According to vendor and EPRI literature, 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 flashunder, 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. This environment and material combination has not previously been evaluated in the GALL Report and constitutes a condition that should 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 and aging that can result in aging effects such as reduced insulation resistance and loss of material which may require 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 materials 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 excrement 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. 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. Considering polymer insulators’ degradation, aging, and failure mechanisms that may require aging management, provide a discussion of any site-specific aging management program needed to ensure that the aging effects such as reduced insulation resistance and loss of material 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.