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

April 7, 2014

Mr. Michael P. Gallagher
Vice President, License Renewal Projects
Exelon Generation Company, LLC
200 Exelon Way
Kennett Square, PA 19348

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BYRON STATION, UNITS 1 AND 2, AND BRAIDWOOD STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION, SET 20 (TAC NOS. MF1879, MF1880, MF1881, AND MF1882)

Dear Mr. Gallagher:

By letter dated May 29, 2013, Exelon Generation Company, LLC, submitted an application pursuant to Title 10 of the *Code of Federal Regulations* Part 54, to renew the operating licenses NPF-37, NPF-66, NPF-72, and NPF-77 for Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2, respectively, for review by the U.S. Nuclear Regulatory Commission (NRC or the staff). The staff is reviewing the information contained in the license renewal application and has identified, in the enclosure, areas where additional information is needed to complete the review.

These requests for additional information were discussed with John Hufnagel, and a mutually agreeable date for the response is within 30 days from the date of this letter. If you have any questions, please contact me at 301-415-4115 or by e-mail at Lindsay.Robinson@nrc.gov.

Sincerely,

Lindsay R. Robinson, Project Manager
Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-454, 50-455, 50-456, and 50-457

Enclosure:
Request for Additional Information

cc: Listserv w/encl

April 7, 2014

Mr. Michael P. Gallagher
Vice President, License Renewal Projects
Exelon Generation Company, LLC
200 Exelon Way
Kennett Square, PA 19348

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/RA/

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Letter to M.P. Gallagher from Lindsay R. Robinson dated April 7, 2014

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BYRON STATION, UNITS 1 AND 2
AND BRAIDWOOD STATION, UNITS 1 AND 2
LICENSE RENEWAL APPLICATION
REQUEST FOR ADDITIONAL INFORMATION, SET 20
(TAC NOS. MF1879, MF1880, MF1881, MF1882)

RAI 3.5.2-5

Applicability:

Byron Station (Byron) and Braidwood Station (Braidwood), all units

Background:

The Generic Aging Lessons Learned (GALL) Report age management program (AMP) XI.S4, "10 CFR Part 50, Appendix J," states that type B (local leakage rate tests – LLRTs) tests are intended to detect local leaks and to measure leakage across each pressure-containing or leakage-limiting boundary of containment penetrations. It also states:

> While the calculation of leakage rates and satisfactory performance of containment leakage rate testing demonstrates the leak-tightness and structural integrity of the containment, it does not by itself provide information that would indicate that aging degradation has initiated...This would be achieved with the additional implementation of an acceptable containment inservice inspection program...

Issue:

License renewal application (LRA) Table 3.5.2-4, "Containment Structure – Summary of Aging Management Evaluation," identifies line items for stainless steel penetration sleeves (guard pipe for fuel transfer tube) and stainless steel and carbon steel penetration sleeves (guard pipe for recirculation sump effluent pipe) exposed to condensation, which will be managed for loss of material and cracking by the 10 CFR Part 50, Appendix J Program. These items are identified as notes "G,8" and "G,10," respectively.

Similarly, LRA Table 3.5.2-8, "Fuel Handling Building – Summary of Aging Management Evaluation," identifies line items for stainless steel penetration sleeves (fuel transfer tube) exposed to condensation, which will be managed for loss of material by the 10 CFR Part 50, Appendix J Program. These items are identified as "G,5" and note that the fuel transfer tube penetration sleeve and penetration bellows inside the Fuel Handling Building are tested concurrently with the fuel transfer tube penetration sleeve and penetration bellows inside the Containment Structures.

It is not clear how the proposed 10 CFR Part 50 Appendix J program, alone, will identify loss of material and cracking, when the primary role of the program for these penetrations is to perform periodic LLRTs.

Request:

1. Clarify if visual inspections are performed as part of the 10 CFR Part 50, Appendix J AMP, or explain how LLRTs will detect cracking and loss of material prior to a loss of

intended function (i.e., pressure boundary, structural support, shelter, protection, water retaining boundary).

2. If an additional or alternate AMP will be used, specify the AMP(s), and revise LRA Table 3.5.2-4 to reflect such changes.

RAI 4.5-1

Applicability:

Byron and Braidwood

Background:

Byron and Braidwood LRA Section 4.5 addresses concrete containment tendon prestress time limited aging analyses (TLAAs). The applicant dispositioned the TLAA per 10 CFR 54.21(c)(1)(iii) because it plans to use an enhanced AMP that the applicant claims to be consistent with the GALL Report AMP X.S1, "Concrete Containment Tendon Prestress." The GALL Report AMP X.S1 recommends further evaluation of the applicant's operating experience that includes measurements, calculations, and documentation of concrete containment tendon prestress. The GALL Report AMP X.S1 states:

> The estimated and measured prestressing forces are plotted against time, and the predicted lower limit (PLL), MRV [minimum required value], and trending lines are developed for the period of extended operation.

LRA Section B.3.1.2 states that the applicant's Concrete Containment Tendon Prestress AMP, implements the American Society of Mechanical Engineers (ASME) Section XI, Subsection IWL program for the required periodic surveillances of individual tendon prestress values, supplemented with the applicable requirements of 10 CFR 50.55a(b)(2) and guidance provided by Regulatory Guide (RG) 1.35.1, "Determining Prestressing Forces for Inspection of Prestressed Concrete Containments."

LRA Section 4.5, Figures 4.5-1 through 4.5-12 contain the applicant's results of the periodic tendon lift-off force surveillances, trend lines based on the regression analyses, and the MRVs for Byron and Braidwood containment tendon groups (vertical, horizontal, and dome) over a 60-year period. ASME Section XI, Subsection IWL-2420, "Unbonded Post-Tensioning Systems," discusses requirements for frequency of tendon lift-off force measurements. RG 1.35.1 addresses the determination of prestress losses as enumerated in "Section CC-3542, "Loss of Prestress," of reference 1, "American Concrete Institute and American Society of Mechanical Engineers Subcommittee on Nuclear Power, 'Code for Concrete Reactor Vessels and Containments,' ACI-359, 1986."

The LRA Updated Final Safety Analysis Report supplement (UFSAR) for Section A.4.5, "Concrete Containment Tendon Prestress Analyses," states:

> Trend lines calculated based on the most recent tendon surveillances for all three tendons groups at Byron and Braidwood Stations, Units 1 and 2, have been extended from 40 years to 60 years.

Issue:

1. The staff reviewed LRA Figures 4.5-1 through 4.5-12 and noted that some of the reported values for control (common) tendons exhibited greater lift-off forces in later years than those recorded at earlier periodic surveillances. As indicated in RG 1.35.1, it is expected that inservice inspections and surveillances will show "expected time dependent losses" (i.e., that tendons will lose prestress over time). The staff needs additional information regarding the increased lift-off force values to determine the effect, if any, on the slope of the regression trend line to 60 years of operation. The staff is also concerned that upward trending control (common) tendon lift-off force values could avert tendon group trend lines from intersecting the MRV line in future inservice inspections and surveillances during the period of extended operation.

2. It is not clear from LRA Figures 4.5-1 through 4.5-12, whether the frequency of lift-off data measurements follows the required frequency of measurements in ASME Section XI, Subsection IWL-2420 for the construction of the group trend lines or whether these lines are calculated based "on the most recent surveillances," as indicated in the (UFSAR) Supplement, Section A.4.5, "Concrete Containment Tendon Prestress Analyses." The staff needs this information in order to review the adequacy of the tendon prestress analysis through the period of extended operation.

Request:

1. State the cause for the recorded upward trending lift-off force measurement shown in Figures 4.5-1 through 4.5-12 of the LRA. Discuss if and how the higher values were considered and implemented when constructing the extended trend line to 60 years of operation.

2. Discuss what years of measurements have been selected for the construction of the trend lines in LRA Figures 4.5-1 through 4.5-12.

RAI 4.5-2

Applicability:

Byron, Unit 2

Background:

LRA Section 4.5 addresses concrete containment tendon prestress TLAAs. The applicant dispositioned the TLAAs per 10 CFR 54.21(c)(1)(iii) because it plans to use an enhanced AMP that the applicant claims to be consistent with the GALL Report AMP X.S1. The GALL Report AMP X.S1 recommends further evaluation of the applicant's operating experience that includes measurements, calculations, and documentation of concrete containment tendon prestress. A review of the LRA Section 4.5, Figures 4.5-2, 4.5-4, and 4.5-6, indicates that the figures include tendon lift-off force data points, regression analyses-based trend lines, and the tendon force MRVs for each tendon group (vertical, horizontal, dome) of Byron Unit 2. The LRA states that the ASME Section XI, Subsection IWL program performs the required ASME Section XI, Subsection IWL periodic surveillances of individual tendon prestress values, supplemented with the applicable requirements of 10 CFR 50.55a(b)(2).

Issue:

During its onsite audit, the staff compared the analyses in LRA Figures 4.5-2, 4.5-4, and 4.5-6 with the Byron, Unit 2, regression analyses contained in the most recent ASME Section XI, Subsection IWL report titled, "Final Report for Exelon Byron Station U1 and U2 25th year Containment Building Tendon Surveillance," (IWL report) and a document titled, "Regression Analysis to Predict Post-Tensioning Forces for Byron Unit 2 Containment Tendons in Support of License Renewal" (license renewal analysis report) and noted the following:

- LRA Figures 4.5-2, 4.5-4, and 4.5-6 indicate that first measurements of lift-off forces for Byron Unit 2 occurred at year one. The IWL report that contains the 60 year tendon lift-off force predictions, however, start at year five instead of year one.
- The IWL report and the license renewal analysis report appear to differ in the number of reported tendon lift-off force data points for the examined tendon groups at certain periodic surveillances.

The staff is unclear as to why the data in the IWL report appears to differ from the data used in the license renewal analysis report. Additionally, it is also not clear which of the two analyses was used to develop LRA Figures 4.5-2, 4.5-4, and 4.5-6.

Request:

Clarify whether there is a difference between the data in the IWL report and the data used for the license renewal analysis report; and if so, (1) provide explanation for the difference, and (2) discuss which of the two reports' data sets were used to develop LRA Figures 4.5-2, 4.5-4, and 4.5-6 and the resulting tendon prestress trend lines extending to 60 year of operation.

RAI B.2.1.30-5

Applicability:

Byron

Background:

LRA Section B.2.1.30 states that the ASME Section XI, Subsection IWL AMP is an existing program that, following enhancements, will be consistent with the GALL Report AMP XI.S2, "ASME Section XI, Subsection IWL." During Byron and Braidwood onsite AMP audits, the staff reviewed operating experience regarding a crack found on the Braidwood Unit 1 primary containment. The crack was found in 2006 during the 25th ASME Section XI, Subsection IWL, visual inspection of the containment concrete. Based on the description in the applicant's action request, the crack is diagonal and located on the upper right corner of the concrete patch placed after the Unit 1 containment concrete was cut out for the steam generator (SG) replacement in 1998. Grease leakage was also observed through the crack. During the Braidwood onsite audit, the staff performed a walkdown to look at the condition of the concrete where the crack was located and noted that there was also a similar crack on the upper left corner of the SG replacement patch in Unit 1's primary containment. Also during the audit, the applicant stated that a similar condition exists for the Byron Unit 1 primary containment concrete at the SG replacement patch.

Issue:

The GALL Report states that "[o]perating experience involving the AMP, including past corrective actions resulting in program enhancements or additional programs, should provide objective evidence to support a determination that the effects of aging will be adequately managed so that the structure and component intended functions will be maintained during the period of extended operation." The GALL Report AMP XI.S2 states that the frequency and scope of examinations specified in 10 CFR 50.55a and ASME Section XI, Subsection IWL, should ensure that aging effects would be detected before they would compromise the design-basis requirements. The GALL Report also states that areas that indicate suspect conditions receive a more rigorous detailed visual examination (as defined by the ASME Code). The staff reviewed a letter dated February 26, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML080570644) that was submitted to the NRC by the applicant, which stated that the condition was evaluated for Braidwood, Unit 1, and was determined to be acceptable because the amount of grease leakage was small. The letter also stated that the grease leakage is being monitored on an annual basis, during the summer months when the sheathing filler viscosity results in the worst-case condition for leakage. Noting that the applicant stated this indication was also found at the Byron, Unit 1, primary containment, the staff needs additional information on if and how the IWL program will be used to manage this aging effect through the period of extended operation for Byron, Unit 1. For Byron, Unit 1, the staff is unclear as to (1) whether more rigorous detailed visual examinations were required or performed, (2) whether the cracking indicates an adverse condition has occurred with the prestressed tendons in that location, and (3) if grease leakage from the cracks is evaluated per the IWL program.

Request:

Describe the actions taken to assess the condition of the cracks, type and frequency of inspections performed (if any), and corrective actions (if any) in accordance with the ASME Section XI, Subsection IWL Program. Also, state whether there has been an evaluation per the IWL Code to assess the amount of grease leakage coming through the cracks and to determine if the leakage has any adverse effect on the ability of the affected tendons to perform their intended function.