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

February 6, 2014

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

SUBJECT: REQUESTS FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE BYRON STATION, UNITS 1 AND 2, AND BRAIDWOOD STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION – AGING MANAGEMENT, SET 8 (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 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 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 301-415-3873 or by e-mail at john.daily@nrc.gov.

Sincerely,

John W. Daily

John W. Daily, Sr. 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:
As stated

cc w/encl: Listserv

February 6, 2014

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

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DATE	01/14/2014	01/28/2014	02/04/2014	02/06/2014

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BYRON STATION, UNITS 1 AND 2
AND BRAIDWOOD STATION, UNITS 1 AND 2
REQUEST FOR ADDITIONAL INFORMATION
AGING MANAGEMENT, SET 8
(TAC NOS. MF1879, MF1880, MF1881, AND MF1882)

RAI 3.1.1-1, Corrosion of external steel surfaces with elevated temperatures in LRA Section 3.1 (010)

Applicability: Byron and Braidwood

Background:

License Renewal Application (LRA) Tables 3.1.2-1 and 3.1.2-4 include carbon and low alloy steel (with or without stainless steel cladding) pressurizer and steam generator components exposed to air with borated water leakage. LRA Table 3.0-1 states that the air with borated water leakage environment is similar to the air-indoor uncontrolled environment, which is described as an environment where the surfaces of components may be wetted, but only rarely.

For the aging management review (AMR) items associated with Item 3.1.1-49 and plant-specific Notes 3 (Table 3.1.2-1) and 4 (Table 3.1.2-4), the LRA states that loss of material due to general, pitting, and crevice corrosion is not applicable. The plant-specific notes state that the components have an external temperature greater than 212 ºF and, therefore, wetting due to condensation and moisture accumulation will not occur.

SRP-LR Section A.1.2.1, "Applicable Aging Effects," Item 7, states, "[t]he applicable aging effects to be considered for license renewal include those that could result from normal plant operation, including plant/system operating transients and plant shutdown."

Issue:

The staff noted that, during refueling outages, the subject pressurizer and steam generator components may be at ambient temperatures for prolonged periods of time, which may or may not be above the dew point. Therefore, they may be susceptible to a condensation environment during outages. The plant-specific notes did not provide a basis for why corrosion is not expected to occur during plant outages.

The Generic Aging Lessons Learned (GALL) Report recommends that GALL Report AMP XI.M36, "External Surfaces Monitoring of Mechanical Components," be used to manage loss of material due to general, pitting, and crevice corrosion for steel components exposed to uncontrolled indoor air.

Request:

Provide the technical basis or operating experience to justify why loss of material due to general, pitting, and crevice corrosion is not an applicable aging effect for the subject pressurizer and steam generator components, given that, during normal plant events such as refueling outages, these components will be at or near ambient temperatures. Alternatively, provide AMR items that describe how this aging effect will be managed.

ENCLOSURE

RAI 3.2.2-1, Corrosion of external steel surfaces in LRA Sections 3.2, 3.4, and 3.5 (010)

Applicability: Byron and Braidwood

Background:

LRA Sections 3.2, 3.4, and 3.5 include several carbon steel components exposed externally to air with borated water leakage for which there is only an AMR item for loss of material due to boric acid corrosion. Conversely, other carbon steel components exposed externally to air with borated water leakage also have a second AMR item for loss of material due to general, pitting, and crevice corrosion. The LRA does not include an explanation for this discrepancy. Components without the second AMR item are present in, but are not necessarily limited to, LRA Tables 3.2.2-1, 3.2.2-2, 3.4.2-1, 3.5.2-3 (graphitic tool steel), and 3.5.2-15.
The staff noted that LRA Table 3.0-1 states that the air with borated water leakage environment is similar to the air-indoor uncontrolled environment, which is described as an environment where the surfaces of components may be wetted, but only rarely. The GALL Report recommends that loss of material due to general, pitting, and crevice corrosion be managed for steel components exposed to uncontrolled indoor air.

Issue:

It is not clear to the staff why some steel components exposed to air with borated water leakage in LRA Sections 3.2, 3.4, and 3.5 are not managed for loss of material due to general, pitting, and crevice corrosion. The GALL Report cites this aging effect for steel exposed to uncontrolled indoor air.

Request:

Provide the technical basis to justify why loss of material due to general, pitting, and crevice corrosion is not an applicable aging effect for several steel components exposed to air with borated water leakage in LRA Sections 3.2, 3.4, and 3.5 (and other sections, if applicable). Alternatively, provide AMR items for this aging effect.

RAI B.2.1.7-7, Addressing MRP-227-A guidance for key input variables of Applicant/Licensee Action Item 1 (017)

RAI B.2.1.7-7: This RAI, due to the complexity of the issue, has been dropped from RAI Set 8 in accordance with the conference call of January 13, 2014. It will be re-issued in a separate RAI set.

RAI 3.1.2-1, Use of the Bolting Integrity program to manage the aging of structural bolting (019)

Applicability: Byron and Braidwood

Background:

LRA Table 3.1.2-1, Reactor Vessel, includes AMR items for carbon and low alloy steel structural bolting, for which loss of material and loss of preload are managed by the Bolting Integrity program. LRA Section B.2.1.9 states that the Bolting Integrity program addresses closure bolting on pressure retaining joints and that the aging of structural bolting is managed by the ASME Section XI, Subsection IWF program, Structures Monitoring Program, or the Regulatory Guide (R.G.) 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants program. GALL Report AMP, XI.M18, "Bolting Integrity," recommends that the aging of structural bolting be managed by AMPs XI.S1, "ASME Section XI, Subsection IWE"; XI.S3, 'ASME Section XI, Subsection IWF"; XI.S6, "Structures Monitoring"; XI.S7, 'RG 1.127, "Inspection of Water-Control Structures Associated with Nuclear Power Plants"; and XI.M23, "Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems."

Issue:

The LRA assigned the Bolting Integrity program to manage the aging of carbon and low alloy steel structural bolting in the reactor vessel; however, neither the LRA program nor the GALL Report program addresses structural bolting. The staff noted that Bolting Integrity program includes inspections for leakage as an indication of bolting degradation, which is only applicable to closure bolting that retains pressure.

Request:

State the specific inspection activities in the Bolting Integrity program that address the aging of carbon and low alloy steel structural bolting in the reactor vessel and revise LRA Section B.2.1.9 to reflect that the Bolting Integrity program manages structural bolting. Alternatively, provide an appropriate AMP that manages the identified aging effects for the subject bolting.

RAI 3.5.2-1, Component support bolting exposed to raw water (019)

Applicability: Byron only

Background:

LRA Table 3.5.2-3, Component Supports Commodity Group, contains an AMR item for stainless steel bolting exposed to raw water (Byron only) that is managed for loss of preload with the Structures Monitoring program. This component has an intended function of structural support and is associated with supports for the emergency diesel generator, HVAC system components, and other miscellaneous mechanical equipment. The LRA does not contain any other AMR items for the subject bolting in the raw water environment.

The GALL Report does not contain a specific AMR item for stainless steel structural bolting exposed to raw water. However, for other stainless steel components, such as piping, the

GALL Report states that loss of material due to pitting, crevice, and microbiologically-influenced corrosion is an applicable aging effect in raw water environments (e.g., GALL Report Item VII.H2.AP-55).

Issue:

It is not clear to the staff why the stainless steel structural bolting exposed to raw water (Byron only) in the component supports commodity group is not managed for loss of material. The GALL Report cites this aging effect for stainless steel components exposed to a raw water environment.

Request:

Provide the technical basis to justify why loss of material due to pitting, crevice, and microbiologically-influenced corrosion is not an applicable aging effect for the stainless steel structural bolting exposed to raw water (Byron only) in LRA Table 3.5.2-3. Alternatively, provide an AMR item for this aging effect and, if applicable, describe the inspection method and frequency for the submerged bolting.

RAI 3.1.2.2.6-1, Condition monitoring activities for SCC of CASS components (073)

Applicability: Byron and Braidwood

Background:

Item 3.1.1-20 in LRA Table 3.1.1 addresses cracking due to stress corrosion cracking (SCC) of cast austenitic stainless steel (CASS) piping components that do not meet the NUREG-0313 guidelines for material selection. LRA Item 3.1.1-20 indicates that cracking due to SCC for these components will be managed by the applicant's Water Chemistry program and ASME Section XI Inservice Inspection (ISI) program. Specifically, LRA Table 3.1.2-1 for the reactor coolant system indicates that cracking of the reactor coolant pressure boundary (RCPB) CASS piping will be managed by using LRA Item 3.1.1-20, consistent with GALL Report Item IV.C2.R-05.

In addition, LRA Section 3.1.2.2.6, Item 2 addresses applicant's further evaluation for aging management for the CASS components associated with LRA Item 3.1.1-20. LRA Section 3.1.2.2.6, Item 2 states that the ISI program includes condition monitoring activities for these RCPB CASS components to ensure that there is no loss of intended function.

Issue:

LRA Section 3.1.2.2.6.2 does not provide specific information on "condition monitoring activities" to demonstrate the adequacy of applicant's aging management. For example, additional information is necessary as to how the conditions of these CASS components will be monitored and what inspection method will be used to manage cracking for these CASS components.

Request:

Provide additional information on the "condition monitoring activities" to demonstrate the adequacy of applicant's aging management for these CASS components (e.g., how the conditions of these CASS components will be monitored and what inspection method will be used).

RAI 4.7.8-1, Flaw Evaluation Plant-specific TLAA (114)

Applicability: Byron and Braidwood

Background:

LRA Section 4.7.8 states that Byron and Braidwood Stations performed pre-emptive flaw evaluations on reactor vessel, pressurizer, primary steam generator sub-components, and primary coolant components. The LRA states that the evaluation methodology uses the number of design cycles as inputs to calculate conservative flaw growth and to develop crack growth reference curves for the components. The LRA states that these flaw evaluations are used to determine if flaws will propagate to unacceptable sizes. The LRA further states that the Fatigue Monitoring Program will be used to ensure that the number of transients used in the curves will not be exceeded during the period of extended operation.

Issue:

The staff is unclear which pressure and thermal transients were used in the flaw evaluation methodology. The staff is unclear which transients will be monitored by the Fatigue Monitoring Program to support the ASME Section XI crack growth analyses.

Request:

Provide the thermal and pressure transients that will be monitored by the Fatigue Monitoring Program to support the ASME Section XI crack growth analyses. For each transient, provide the number of design transient cycles assumed in the flaw evaluations.

RAI B.2.1.12-1, Opportunistic Inspections in the Closed Treated Water Systems Program (022)

Applicability: Byron and Braidwood

Background:

GALL Report AMP XI.M21A, "Closed Treated Water Systems," recommends conducting visual inspections to detect aging whenever the system pressure boundary is opened (i.e., opportunistic inspections). The GALL Report AMP also states that inspections are conducted in accordance with applicable code requirements or the selected industry standard. Absent an applicable code or standard, plant-specific inspection and personnel qualification procedures capable of detecting corrosion or cracking may be used.

The program description in LRA Section B.2.1.12, Closed Treated Water Systems, and the program basis document, BB-PBD-AMP-XI.M21A, state that existing condition monitoring activities provide for opportunistic visual inspections. However, during the staff's audit of the program, the staff was not able to confirm that the existing program includes inspections capable of detecting corrosion and cracking whenever the system boundary is opened.

Issue:

The existing Closed Treated Water Systems program appears to be inconsistent with GALL Report AMP XI.M21A with respect to the inclusion of opportunistic inspections. As a result, it is not clear to the staff whether the program is capable of detecting corrosion and cracking prior to loss of intended function.

The staff noted that site personnel receive general training to identify conditions in the plant on an ongoing basis; however, that practice does not include specific inspection and personnel qualification procedures to ensure that corrosion and cracking can be detected in the closed treated water systems.

Request:

1. If available, provide the portions of the implementing procedures for the Closed Treated Water Systems program that demonstrate that the existing program includes opportunistic inspections that are guided by specific inspection and personnel qualification procedures capable of detecting corrosion and cracking.

2. If the existing program does not include such opportunistic inspections, provide the technical justification that demonstrates that loss of material and cracking will be adequately managed. Alternatively, provide an enhancement to the program to include these inspections.

RAI 3.5.2-2, PVC conduit exposed to groundwater or soil (092)

Applicability: Byron and Braidwood

Background:

LRA Table 3.5.2-15 states that for polyvinyl chloride (PVC) conduit exposed to groundwater/soil, there is no aging effect and no AMP is proposed.

Issue:

The staff reviewed the associated items in the LRA to confirm that no credible aging effects are applicable for this component, material and environmental combination. While the staff recognizes that there are no AMR items for PVC conduit exposed to groundwater/soil, the "scope of program" program element of LR-ISG-2011-03, "Changes to the Generic Aging Lessons Learned (GALL) Report Revision 2 Aging Management Program (AMP) XI.M41, 'Buried and Underground Piping and Tanks'," states, "[t]his program manages the effects of aging for buried and underground piping and tanks constructed of any material including metallic, polymeric, cementitious, and concrete materials." Although conduit is not within the scope of LR-ISG-2011-03, the ISG provides the staff insight that buried polymeric components have aging effects that should be managed. LRA Table 3.5.2-15 states that the intended functions of the buried conduit are shelter protection and structural support. Although these intended functions are different than that associated with buried piping, which is typically pressure boundary, leaks in the conduit could adversely impact the intended function of the cables that are inside the conduit if the cable jacketing was degraded.

The "program description" of GALL Report AMP XI.E3, "Inaccessible Power Cables not Subject to 10 CFR 50.49 Environmental Qualification Requirements," states:

> Most electrical cables in nuclear power plants are located in dry environments. However, some cables may be exposed to wetting or submergence, and are inaccessible or underground, such as cables in conduits, cable trenches, cable troughs, duct banks, underground vaults, or directly buried in soil installations. When a power cable (greater than or equal to 400 volts) is exposed to wet, submerged, or other adverse environmental conditions for which it was not designed, an aging effect of reduced insulation resistance may result, causing a decrease in the dielectric strength of the conductor insulation. This insulation degradation can be caused by wetting or submergence. This can potentially lead to failure of the cable's insulation system.

It is not clear to the staff how buried conduit with intended functions of shelter protection and structural support will have no aging effects and no recommended AMP.

<u>Request</u>:

State the basis for why potential aging effects for buried PVC conduit with intended functions of shelter protection and structural support are not being age-managed or propose an AMP to manage the aging effects.

RAI 3.5.2-3, Polymeric conduit exposed to air-indoor uncontrolled environment (092)

<u>Applicability</u>: Byron and Braidwood

<u>Background</u>:

LRA Table 3.5.2-15 states that for polymeric conduit exposed to air-indoor uncontrolled, there is no aging effect and no AMP is proposed.

The AMR items cite plant specific note 2, which states, "[t]his material and environment applies to the vinyl covering on flexible, liquid-tight conduit in air-indoor environment. Based on plant operating experience, there are no aging effects requiring management for the combination of these materials and environments. The material in this environment is not expected to experience significant aging effects."

Issue:

The staff noted that vinyl materials can be supplied in a wide range of compositions. Depending upon the composition, environmental factors such as temperature, radiation, and proximity to fluorescent lighting which emits ultraviolet radiation can affect the manner in which the component ages. The staff lacks sufficient information to determine that there are no aging effects associated with these components.

Request:

1. State the specific composition of the vinyl covering on flexible, liquid-tight conduit.
2. State the specific values (e.g., maximum operating temperature, expected integrated dose for 60 years, ultraviolet levels) of environmental factors in the various or worst case locations where the vinyl covering on flexible, liquid-tight conduit is located.
3. State the basis for why there are no aging effects to manage for the vinyl covering on flexible, liquid-tight conduit or propose an aging management program to manage the aging effects.

RAI 3.5.2-4, Thermal insulation aging effects for air-indoor uncontrolled or air with borated water leakage (092)

Applicability: Byron and Braidwood

Background:

LRA Table 3.5.2-15, states that for thermal insulation exposed to air-indoor uncontrolled and air with borated water leakage and composed of calcium silicate, ceramic fiber, fiberglass, foamed plastic, and mineral fiber, there is no aging effect and no AMP is proposed.

The AMR items cite plant-specific Note 4, which states, "[o]perating experience has shown the air-indoor uncontrolled and air with borated water leakage environments to contain insignificant quantities of moisture, humidity, condensation, and contaminants during normal operation. Therefore, there are no aging effects associated with the insulation material in the normally dry, air - indoor uncontrolled and air with borated water leakage environments."

Issue:

The staff noted that:

- In a normally dry environment without the potential for water leakage, spray, or condensation, most insulation materials are expected to be inert to environmental effects. However, in moist environments, many insulation materials have been found to degrade. Some have the potential for prolonged retention of any moisture to which they are exposed; prolonged retention of moisture may increase thermal conductivity, thereby degrading the insulating characteristics, and also could accelerate the aging effects of insulated components.
- The description of air-indoor uncontrolled in LRA Table 3.0-1, "Byron and Braidwood Service Environments," includes the statement, "[s]urfaces of components in this

environment may be wetted, but only rarely; equipment surfaces are normally dry." Although the surfaces are only rarely wetted in this air environment, insulation can retain the moisture and its ability to reduce heat transfer will be degraded. The staff infers from the description of the air with borated water leakage environment that leakage from components in the vicinity could impact insulation.

- The staff lacks sufficient information to conclude that routine sweating of pipes that could drip onto insulation located below the pipe during humid conditions would be identified in the corrective action program and whether the insulation would be inspected for water damage and corrected as necessary.
- The description of ceramic fiber, fiberglass, and foamed plastic lack sufficient specificity to determine if these insulating materials can retain moisture if wetted. The staff believes that calcium silicate and mineral fiber insulation will retain moisture when wetted; at least for an indeterminate period of time.
- LRA Table 3.5.2-15 includes insulation jacketing which, if properly installed, provides protection from ambient moisture for the insulating materials.

Overall, the staff lacks sufficient information to conclude that thermal insulation exposed to air-indoor uncontrolled and air with borated water leakage and composed of calcium silicate, ceramic fiber, fiberglass, foamed plastic, and mineral fiber, has no aging effect.

Request:

1. For the above described insulation components in LRA Table 3.5.2-15 state:
   a. Whether all in-scope insulation is covered by jacketing; and
   b. how the configuration control plant-specific procedures for jacketing ensure that the jacketing is properly installed so as to prevent water intrusion into the insulation (e.g., seams on the bottom, overlapping seams) such that it can be reasonably concluded that the thermal insulation exposed to air-indoor uncontrolled and air with borated water leakage and composed of calcium silicate, ceramic fiber, fiberglass, foamed plastic, and mineral fiber, has no aging effect.

2. If all in-scope insulation is not covered by jacketing or configuration control plant-specific procedures for jacketing, as described in Request 1b., do not exist, respond to the following:
   a. State the basis for why insulation without jacketing installed to configuration control plant-specific procedures for jacketing, as described in Request 1b has no aging effects in light of the potential for periodic moisture intrusion.
   b. State whether sweating of pipes during plant operation is identified as a condition adverse to quality in the corrective action program. If it is, provide evidence that either sweating is not occurring or that it has routinely been identified and corrected, including inspection of potentially wetted insulation.
   c. Provide sufficient information for the staff to determine if the ceramic fiber, fiberglass, and foamed plastic insulating materials can retain moisture if wetted.
   d. Alternatively to Requests 2a, 2b, and 2c, amend the LRA to include aging management of reduction of insulation effectiveness for in-scope thermal insulation.

Letter to M. P. Gallagher from John W. Daily dated February 6, 2014

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