



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

February 18, 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 NUCLEAR STATION, UNITS 1 AND 2, AND BRAIDWOOD NUCLEAR
STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION – AGING
MANAGEMENT - SET 7 (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 Nuclear Station, Units 1 and 2, and Braidwood Nuclear 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,

A handwritten signature in black ink that reads "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 18, 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 NUCLEAR STATION, UNITS 1 AND 2, AND BRAIDWOOD NUCLEAR STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION – AGING MANGEMENT - SET 7 (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 Nuclear Station, Units 1 and 2, and Braidwood Nuclear 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,

/RA/

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

DISTRIBUTION:
See next page

ADAMS Accession No.: ML14007A603

*concurring via email

OFFICE	LA: DLR/RPB2	PM: DLR/RPB1	BC: DLR/RPB1	PM: DLR/RPB1
NAME	lKing	JDaily	YDiaz-Sanabria	JDaily
DATE	01/14/2014	02/18/2014	02/18/2014	02/18/2014

OFFICIAL RECORD COPY

BYRON NUCLEAR STATION, UNITS 1 AND 2
AND BRAIDWOOD NUCLEAR STATION, UNITS 1 AND 2
REQUESTS FOR ADDITIONAL INFORMATION
AGING MANAGEMENT - SET 7
(TAC NOS. MF1879, MF1880, MF1881, AND MF1882)

RAI B.2.1.16-1 Corrosion and flow blockage in fire protection piping

Applicability: Byron Nuclear Station, Units 1 and 2 (Byron) and Braidwood Nuclear Station, Units 1 and 2 (Braidwood)

Background:

During its review of plant-specific operating experience, the staff identified instances of potential flow blockage of fire water systems at Byron. Examples include:

- Corrective action reports AR 01088598, AR 01482910 and AR 00798599 document a sprinkler alarm not clearing and finding flow blockage during inspections. These ARs span 2008 to 2013.
- Although addressed by the corrective action program, the “operating experience” program element of license renewal application (LRA) Section B.2.1.16 states that in March 2008 nine spray nozzles for an auxiliary transformer were discovered plugged during a deluge system flush.

The NRC’s recent Information Notice (IN) 2013-06, “Corrosion in Fire Protection Piping Due to Air and Water Interaction,” identifies blockages in fire sprinkler piping due to accumulation of corrosion products. The associated operating experience has caused the staff to reconsider the current approach in Generic Aging Lessons Learned (GALL) Report aging management program (AMP) XI.M27, “Fire Water System,” that allows the use of non-intrusive techniques for identifying loss of material to be used in lieu of internal visual inspections or flow tests for identifying blockages. Non-intrusive inspection techniques cannot reliably be used to ensure that the system remains functional because quantities of corrosion products sufficient to block flow could be released into the system despite the remaining pipe wall thickness meeting wall thickness acceptance criteria. In addition, as stated in IN 2013-06, degradation in fire protection systems can be detected before a loss of function by inspecting and testing the systems in accordance with National Fire Protection Association (NFPA) standards. Consequently, the staff considers that the recommendations in AMP XI.M27 should be changed as follows (interim staff guidance is currently being finalized):

- Inspections and tests related to loss of material and flow blockage should meet NFPA recommendations, as listed in the attached Table 1, “Fire Water System Inspection and Testing Recommendations.”
- For portions of water-based fire protection systems that are designed to be normally dry but are periodically subjected to flow (e.g., dry-pipe or preaction sprinkler system piping and valves), augmented inspections consisting of periodic wall thickness measurements, and either visual examinations or full flow testing should be performed in the portions of this piping that are not configured to completely drain.

ENCLOSURE

LRA Section B.2.1.16, "Fire Water System," states that system functional tests, flow tests, flushes, and inspections are performed in accordance with the applicable guidance from NFPA codes and standards and that these activities are performed to ensure that system and component intended functions are maintained. However, the LRA also states that pipe wall thickness inspections are capable of evaluating the inner diameter of the piping as it applies to the flow requirements of the fire protection system.

Issue:

Based on its reviews during the AMP audit, it is not clear to the staff that the Byron and Braidwood Fire Water System program is consistent with the staff considerations above. In addition, it is not clear how pipe wall thickness inspections are capable of evaluating the inner diameter of the piping as it applies to the flow requirements of the system.

Request:

1. Either confirm that the current Fire Water System program conducts inspections and tests related to loss of material and flow blockage of associated components in accordance with the guidance in Table 1, below, including aspects such as the type of inspection or test, frequency of performance, acceptance criteria, etc., or provide justification to demonstrate that the current activities will adequately manage the effects of aging so that the intended functions will be maintained.
2. If wall thickness evaluations will be used in lieu of conducting flow tests or internal visual examinations, state the bases for why wall thickness measurements in the absence of flow testing or internal visual examinations provide reasonable assurance that the intended functions of in-scope fire water system components will be maintained consistent with the current licensing basis (CLB) for the period of extended operation (PEO). In addition, either provide the technical bases for how pipe wall thickness inspections are capable of evaluating the inner diameter of the piping as it applies to the flow requirements of the fire protection system, or modify that statement in the LRA to reflect technically justifiable bases.
3. Either confirm that follow-up volumetric examinations will be conducted whenever internal visual inspections detect surface irregularities indicative of material loss below nominal wall thickness, or provide the bases for why the visual inspection alone will provide reasonable assurance that the intended functions of in-scope fire water system components will be maintained consistent with the CLB for the PEO. Alternatively, add a requirement to the program to conduct follow-up volumetric examinations.
4. For portions of water-based fire protection system that are designed to be normally dry but are periodically subjected to flow and are not configured to completely drain, state the following:
 - a. The inspection method to ensure that fouling is not occurring.
 - b. The parameters to be inspected.
 - c. When inspections will commence and the frequency of subsequent inspections.
 - d. The extent of inspections and the basis for the extent of inspections if it is not 100 percent.
 - e. Acceptance criteria.
 - f. How much of this piping will be periodically inspected for wall thickness and how often the inspections will occur.
5. If necessary, provide revisions to LRA Section 3 Table 2s, Appendix A, and Appendix B.

Table 1 Fire Water System Inspection and Testing Recommendations^{1, 2, 5}	
Description	NFPA 25 Section
Sprinkler Systems	
Sprinkler inspections	5.2.1.1
Sprinkler testing	5.3.1
Standpipe and Hose Systems	
Flow tests	6.3.1
Private Fire Service Mains	
Underground and Exposed Piping Flow Tests	7.3.1
Hydrants	7.3.2
Fire Pumps	
Suction screens	8.3.3.7
Valves and System-Wide Testing	
Main drain test	13.2.5
Deluge valves	13.4.3.2.2 - 13.4.3.2.5
Water Spray Fixed Systems	
Strainers (refueling outage interval and after each system actuation)	10.2.1.6, 10.2.1.7, 10.2.7
Operation Test (refueling outage interval)	10.3.4.3
Foam Water Sprinkler Systems	
Strainers (refueling outage interval and after each system actuation)	11.2.7.1
Operational Test Discharge Patterns (annually) ⁶	11.3.2.6
Storage tanks (internal – 10 years)	Visual inspection for internal corrosion
Obstruction Investigation	
Obstruction, internal inspection of piping ³	14.2 and 14.3
<p>Notes:</p> <ol style="list-style-type: none"> 1. All terms and references are to the 2011 Edition of NFPA 25. The staff is referencing the 2011 Edition of NFPA 25 for the description of the scope and periodicity of specific inspections and tests. This table specifies those inspections and tests that are related to age-managing applicable aging effects that are associated with loss of material and flow blockage for passive long-lived in-scope components in the fire water system. Inspections and tests not related to the above should be continued to be conducted in accordance with the plant's current licensing basis. If the current licensing basis states more frequent inspections than required by NFPA 25 or this table, the plant's current licensing basis should be continued to be met. 2. A reference to a section includes all sub-bullets unless otherwise noted (e.g., a reference to 5.2.1.1 includes 5.2.1.1.1 through 5.2.1.1.7). 3. The alternative nondestructive examination methods permitted by 14.2.1.1 and 14.3.2.3 are limited to those that can ensure that flow blockage will not occur. 4. (Not Used) 5. Items in areas that are inaccessible for safety considerations due to factors such as continuous process operations, radiological dose, and energized electrical equipment shall be inspected during each scheduled shutdown but at least once every refueling outage 	

Table 1 Fire Water System Inspection and Testing Recommendations^{1, 2, 5}

interval.

6. Where the nature of the protected property is such that foam cannot be discharged, the nozzles or open sprinklers shall be inspected for correct orientation and the system tested with air to ensure that the nozzles are not obstructed.

RAI B.2.1.16-2 Guided wave and ultrasonic inspections of fire water system components

Applicability: Byron

Background:

The “operating experience” program element of LRA Section B.2.1.16, “Fire Water System” states that Byron performed an analysis in March 2007 to identify any common causes for the 14 through-wall leaks that were identified in the fire water system between January 2002 and January 2007. The analysis concluded that the likely cause of the leaks was microbiologically-induced corrosion (MIC).

Enhancement No 2 to the program will “[p]rovide for chemical addition, accompanied with system flushing to allow for adequate dispersal of the chemicals throughout the system, to prevent or minimize microbiologically induced corrosion.” In addition, the LRA states that guided wave inspections are used to identify locations of potential wall thinning caused by MIC and follow-up ultrasonic examinations are performed to determine if piping replacement is required.

Issue:

The corrective actions associated with the leaks that have occurred in the fire water system included guided wave and ultrasonic examinations. The LRA states, “[f]ollow-up ultrasonic testing is performed at locations identified by the guided wave inspections to determine if replacement of piping is required.” It appears to the staff that the corrective actions may have been effective to date because they include chemical treatments to mitigate the spread of MIC and inspections to appropriately identify components that should be replaced. Although the program basis document states that non-intrusive inspections are performed on a representative number of locations, the staff notes that the implementing procedures for the Fire Water System program do not specify the current process of using guided wave and ultrasonic examinations and do not include a minimum number of inspections to be conducted.

Request:

In regard to guided wave testing in conjunction with ultrasonic wall thickness measurement, provide details showing that the current implementing procedures reflect the use of this technique and that these examinations include the most susceptible portions of the system. Also provide details showing that the current implementing procedures include a minimum number of locations to be inspected at the current frequency of 3 years.

If the above information is not included in the current implementing procedures, **either** provide the basis to demonstrate that, without this information in the implementing procedures, the

effects of aging will be adequately managed by the Fire Water System program so that the intended functions of the associated components will be maintained consistent with the CLB for the PEO, or provide an enhancement to revise the current implementing procedures to reflect the above information.

RAI 3.1.2.3-1 Aging management of core barrel assembly (barrel plates and nozzles)

Applicability: Byron and Braidwood

Background:

LRA Table 3.1.2-3 indicates that the core barrel assembly (barrel plates and nozzles) will be managed by the PWR Vessel Internals Program for the effects of changes in dimension, cracking and loss of fracture toughness. The staff noted that Section 4 of MRP-227-A and LRA Appendix C do not identify the core barrel assembly (barrel plates and nozzles) in the “primary,” “expansion” or “existing program” inspection categories. The staff also noted that MRP-191 does not identify the core barrel assembly (barrel plates and nozzles) as categorized as a “Category A” component.

Issue:

Since the core barrel assembly (barrel plates and nozzles) is not identified in LRA Appendix C, Section 4 of MRP-227-A or MRP-191, it is not clear to the staff how the PWR Vessel Internals Program will be used to manage the effects of changes in dimension, cracking and loss of fracture toughness in these components. Specifically, the applicant has not identified the details of the inspection for these components, including details on the inspection category, inspection method, frequency, coverage and acceptance criteria, expansion link, and, any additional programmatic criteria.

Request:

- Explain and justify how the core barrel assembly (barrel plates and nozzles) will be managed for effects of changes in dimension, cracking and loss of fracture toughness by the PWR Vessel Internals Program. The response should address, but is not limited to, the inspection category, inspection method, frequency, coverage and acceptance criteria, expansion link, and, any additional programmatic criteria associated with the inspection.
- Revise the LRA, as necessary (e.g., LRA Table 3.1.2-3, LRA Appendix B.2.1.7, response to Applicant/Licensee Action Item No. 2, LRA Appendix C).

RAI 3.1.2.3-2 Aging management of core barrel assembly (upper and lower core barrel cylinder girth welds)

Applicability: Byron and Braidwood

Background:

Table A of LRA Appendix C identifies the Core Barrel Assembly: Upper and Lower Core Barrel Cylinder Girth Welds as being managed for the effects of cracking, loss of fracture toughness and changes in dimensions as a “primary” inspection category component in the PWR Vessel Internals Program.

Table B of LRA Appendix C identifies the Lower Internals Assembly: Lower Support Forging as being managed for the effects of cracking, loss of fracture toughness and changes in dimensions as an “expansion” inspection category component in the PWR Vessel Internals Program.

Issue:

The staff noted that both components were identified as being inspected by the PWR Vessel Internals Program; however, neither of the components discussed above was identified by the applicant in its aging management review results in LRA Table 3.1.2-3. In accordance with 10 CFR 54.21(a)(1) and (a)(3), the applicant is to identify and list those structures and components subject to an aging management review and demonstrate that the effects of aging on these components will be adequately managed for the PEO, respectively.

Request:

- Justify the discrepancy described above between LRA Table 3.1.2-3 and Tables A and B in LRA Appendix C. If necessary, revise LRA Table 3.1.2-3.
- Confirm that all reactor vessel internals components that are within the scope of license renewal and subject to aging management are identified in LRA Section 3.1. This is to include, but is not limited to, components in the “primary,” “expansion,” “existing program” and “no additional measure” inspection categories of the PWR Vessel Internals Program.
 - If the applicable components are not identified, revise LRA Section 3.1 accordingly or justify that revisions are not needed to identify all reactor vessel internals components that are subject to an aging management review and to demonstrate that the effects of aging on these components will be adequately managed for the period of extended operation in accordance with 10 CFR 54.21(a)(1) and (a)(3), respectively.

Letter to M. P. Gallagher from John W. Daily dated February 18, 2014

**SUBJECT: REQUESTS FOR ADDITIONAL INFORMATION FOR THE REVIEW OF THE
 BYRON NUCLEAR STATION, UNITS 1 AND 2, AND BRAIDWOOD NUCLEAR
 STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION – AGING
 MANGEMENT - SET 7 (TAC NOS. MF1879, MF1880, MF1881, AND MF1882)**

DISTRIBUTION:

E-MAIL:

PUBLIC

RidsNrrDir Resource

RidsNrrDirRpb1 Resource

RidsNrrDirRpb2 Resource

RidsNrrDraApla Resource

RidsNrrPMByron Resource

RidsNrrPMBraidwood Resource

RidsOgcMailCenter

JDaily

LRobinson

DMcIntyre, OPA

EDuncan, RIII

JBenjamin, RIII

AGarmoe, RIII

JMcGhee, RIII

JRobbins, RIII

VMitlyng, RIII

PChandrathil, RIII