



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

February 7, 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, SET 13 (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 e-mail Lindsay.Robinson@nrc.gov.

Sincerely,

A handwritten signature in black ink, appearing to read "LR", with a long horizontal flourish extending to the right.

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:
Requests for Additional Information

cc: Listserv

February 7, 2014

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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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DATE	2/3/14	2/4/14	2/6/14	2/7/14	2/7/14

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BYRON STATION, UNITS 1 AND 2,
AND BRAIDWOOD STATION, UNITS 1 AND 2,
LICENSE RENEWAL APPLICATION
REQUESTS FOR ADDITIONAL INFORMATION , SET 13
(TAC NOS. MF1879, MF1880, MF1881, MF1882)

RAI B.2.1.31-1

Applicability:

Byron Station (Byron) and Braidwood Station (Braidwood)

Background:

The Generic Aging Lessons Learned (GALL) Report aging management program (AMP) XI.S3 recommends that the ASME Section XI, Subsection IWF AMP augment the requirements of the existing ASME Section XI, Subsection IWF program (required in accordance with 10 CFR 50.55a) to include monitoring of high-strength structural bolting with actual measured yield strength greater than or equal to 150 ksi or 1,034 MPa for cracking. Several program elements of the GALL Report AMP XI.S3 specify recommendations for aging management of high-strength structural bolting:

1. The "Preventive Actions" program element of the GALL Report AMP XI.S3 recommends (1) using bolting material that has an actual measured yield strength less than 150 ksi; and (2) for structural bolting consisting of ASTM A325, ASTM F1852, and/or ASTM A490 bolts, the preventive actions for storage, lubricants, and stress corrosion cracking (SCC) potential discussed in Section 2 of Research Council for Structural Connections (RCSC) publication "Specification for Structural Joints Using ASTM A325 or A490 Bolts" need to be used.
2. The "Parameters Monitored or Inspected" program element recommends that high-strength structural bolting susceptible to SCC be monitored for SCC.
3. The "Detection of Aging Effects" program element recommends that, for high-strength structural bolting in sizes greater than 1" nominal diameter, volumetric examination should be performed in addition to the VT-3 examination to detect cracking and that this volumetric examination may be waived with adequate plant-specific justification.

Issue:

During an onsite audit and review of the license renewal application (LRA) AMP, "ASME Section XI, Subsection IWF," the staff noted that the AMP states IWF supports at Byron and Braidwood do not use high-strength bolts susceptible to SCC. However, in discussions with the applicant during its onsite audit, the staff noted that there may be high-strength bolting (i.e., ASTM A490) in sizes greater than 1" diameter and actual yield strength greater than 150 ksi that is applicable to the IWF program but that was not considered for SCC potential, as recommended in the GALL Report AMP XI.S3. Specifically:

1. The AMP does not state whether the applicant plans to discontinue use of high-strength structural bolting (actual yield strength greater than 150 ksi).

ENCLOSURE

2. If there are structural bolts that are high-strength and greater than 1" diameter, it is not clear if or how the applicant plans to manage cracking due to SCC in accordance with the recommendations of the GALL Report AMP XI.S3.

Request:

1. Identify whether there are high-strength structural bolts (i.e., ASTM A490) that were not previously identified for aging management of cracking due to SCC in accordance with the GALL Report AMP XI.S3. If ASTM A490 bolts are used but are not considered for SCC potential, provide technical justification for this exception to the recommendations of the GALL Report.
2. Describe how the recommendations in the "Preventive Actions," "Parameters Monitored or Inspected," and "Detection of Aging Effects" program elements are addressed, including the use of high-strength bolting materials, preventive actions for storage, lubricants, and SCC in accordance with Section 2 of the RCSC document and the VT-3 utilized to manage aging for SCC potential. If the program will not address the recommendations in the above-mentioned program elements for high-strength bolting or does not manage aging for these components, provide the associated technical justification.

RAI B.2.1.31-2

Applicability:

Byron and Braidwood

Background:

The "Preventive Actions" program element of the GALL Report AMP XI.S3 states that the use of molybdenum disulfide (MoS_2) as a lubricant is a potential contributor to SCC, especially when applied to high-strength bolting. The applicant's ASME Section XI, Subsection IWF AMP basis document states that MoS_2 was used as a lubricant for faying surfaces of NSSS supports but not as a thread lubricant.

Issue:

There is no enhancement to the program to specifically prohibit the use of MoS_2 lubricants on structural bolting. It is not clear to the staff whether the applicant plans to prohibit the use of MoS_2 lubricant for structural bolting in the future.

Request:

State whether the program will be enhanced to specifically prohibit the use of MoS_2 on structural bolting. If so, update the LRA and updated final safety analysis report supplement to include this enhancement. If not, state how the program will ensure that MoS_2 lubricant is not used or that it will not be a potential contributor to SCC.

RAI B.2.1.31-3

Applicability:

Byron and Braidwood

Background:

The "Detection of Aging Effects" program element of the GALL Report AMP XI.S3 recommends that for high-strength structural bolting (actual measured yield strength greater than 150 ksi) in sizes greater than 1" diameter, volumetric examination should be performed in addition to VT-3 examination. The GALL Report also states that this volumetric examination may be waived with adequate plant-specific justification.

LRA Section B.2.1.31 states that for the 5" diameter high-strength reactor coolant pump (RCP) hold-down bolts at Byron and Braidwood and the 1½" diameter pressurizer hold-down bolts at Braidwood, the applicant takes exception to the GALL Report recommendation that periodic volumetric examinations be performed. The staff reviewed LRA Section B.2.1.31 ASME Section XI, Subsection IWF AMP supporting documentation during the onsite audit and noted that the applicant does not consider cracking due to SCC applicable to these bolts. The applicant uses the following plant-specific justification to waive the GALL Report recommended volumetric examinations in addition to VT-3 visual examination:

- The bolt design is in a configuration that precludes water from penetrating the interface between the bolt head and support surface and seeping beneath the bolt head, which prevents the potential initiation of corrosion. The bolts were torqued to bear tightly on the support surface.
- Metal-plated stud bolting is not used, which could cause degradation due to corrosion or hydrogen embrittlement.
- An approved lubricant was applied to the bolts; this lubricant did not contain MoS₂.
- There have been no recordable indications of degradation identified by ASME Section XI, Subsection IWF program examinations that would indicate the potential for SCC to occur.

Issue:

The staff reviewed the applicant's plant-specific justification to waive volumetric examinations of the RCP hold-down bolts and pressurizer hold-down bolts as well as the applicant's plan to use visual examinations only to manage aging of these components. The staff identified the following concerns:

- The ASME Section XI, Subsection IWF AMP basis documents state that the RCP hold-down bolts are located in an "air with borated water leakage" environment. Since there is a potentially moist environment, susceptible material, and stress present to cause SCC, the GALL Report AMP XI.S3 recommends that high-strength bolting in sizes greater than 1" should be managed for SCC. An onsite review of the design drawings for the bolt configuration determined that there is no physical seal preventing water intrusion beneath the bolt head. The staff does not have enough information to confirm that the surface between the bolt head and support surface is watertight.

- The AMP basis document states that the applicant examines the bolts using ASME Section XI, Subsection IWF Table IWF-2500-1, which states that for supports other than piping supports (class 1, 2, 3 or MC), VT-3 examination of 100 percent of the bolts should be performed each inspection interval of ten years. The staff needs more information on how the VT-3 examination will ensure that SCC will be detected and that any effects of cracking due to SCC will be managed. The AMP does not indicate what parameters or criteria would be used to detect SCC and how they would be effective in identifying SCC potential.
- The program does not identify actions to be taken (i.e., use ASME IWF criteria for expansion of scope, increase in inspection frequency, or perform volumetric examinations) if there are indications that SCC could be occurring.
- The applicant's previous experience with the IWF program indicates that cracking due to SCC has not been found to be a degradation mechanism. However, since the IWF examination does not include volumetric examination for cracking beneath the bolt head for high-strength structural bolts greater than 1" diameter, the operating experience referenced by the applicant does not preclude the potential for SCC for these components. During the onsite audit, the applicant stated that it does not have a history of volumetric examinations of similar bolting to show that there is no evidence of SCC.

Request:

Provide further technical justification to support a plant-specific waiver for periodic volumetric examination of high-strength RCP and pressurizer hold-down bolts. Discuss how the ASME Section XI, Subsection IWF program will verify the absence of cracking due to SCC for the 5" SA540 high-strength RCP hold-down bolts and the 1½" pressurizer hold-down bolts. Specifically:

1. For both plants, provide results of any plant-specific history of volumetric examination of high-strength bolts in a similar environment to support a plant-specific justification to waive future volumetric examinations as recommended in the GALL Report. If there is no history of volumetric examination of the referenced bolts, state whether any volumetric examinations (or alternative methods) will be conducted prior to period of extended operation (PEO) to confirm that cracking due to SCC has not affected the bolt threads.
2. State what parameters or criteria will be used to detect SCC or a corrosive environment and how visual inspections will be effective in detecting future SCC or corrosive environment. State how the program will ensure that a noncorrosive environment is maintained throughout the IWF interval.
3. State what actions will be taken with respect to augmented examinations if inspections result in indications that there is degradation or a corrosive environment that could lead to SCC, including any plans for supplemental volumetric examinations or evaluations.

RAI B.2.1.27-1

Applicability:

Byron and Braidwood

Background:

Both Byron and Braidwood have operating experience where the coupon tree holding the Boral sample coupons was not surrounded by freshly discharged fuel in accordance with the original equipment manufacturer's recommendations.

Issue:

In order to have an effective coupon monitoring program, the coupons should be the leading indicators of material degradation as compared to the neutron absorber material in the spent fuel storage racks. That is, the dose received and/or long-term exposure to the wet pool environment by the coupons should be bounding of the material in the racks. Allowing the coupons to lead the neutron absorber material in the racks provides reasonable assurance that the applicant will detect any material degradation in the coupons before the material in the spent fuel pool racks starts to degrade.

Request:

Please discuss how the coupon exposure (i.e., coupon tree location) will provide reasonable assurance that Boral degradation is identified prior to potential loss of neutron-absorbing capability of the material in the spent fuel racks. If the coupon exposure to the environment is not bounding of the material in the racks, discuss how the aging effects of the Boral material will be managed for the unbounded racks.

RAI B.2.1.10-1

Applicability:

Byron and Braidwood

Background:

LRA Section B.2.1.10 Enhancement 1 provides three options the applicant may take to disposition potential primary water stress corrosion cracking (PWSCC) of the Byron and Braidwood Units 1 and 2 steam generator divider plate welds to the primary head and tubesheet cladding. The second option for Enhancement 1 indicates that an analytical evaluation will be performed to establish a technical basis to disposition the potential degradation mechanism.

Option 2: Analysis

Perform an analytical evaluation of the steam generator divider plate welds in order to establish a technical basis which concludes that the steam generator reactor coolant pressure boundary is adequately maintained with the presence of steam generator divider plate weld cracking. The analytical evaluation will be submitted to the NRC for review and approval prior to entering associated PEO.

Option 2: Analysis – Susceptibility

Perform an analytical evaluation of the steam generator tube-to-tubesheet welds to determine that the welds are not susceptible to PWSCC. The evaluation for determining that the tube-to-tubesheet welds are not susceptible to PWSCC will be submitted to the NRC for review and approval prior to entering the associated PEO.

Option 3: Analysis – Pressure Boundary

Perform an analytical evaluation of the steam generator tube-to-tubesheet welds redefining the reactor coolant pressure boundary of the tubes, where the steam generator tube-to-tubesheet welds are not required to perform a reactor coolant pressure boundary function. The redefinition of the reactor coolant pressure boundary will be submitted to the NRC for review and approval prior to entering the associated PEO.

In the case of the applicant choosing Option 2 for Enhancement 1 and Option 2 or 3 for Enhancement 2, the staff is to review and approve the analysis prior to the Byron and Braidwood Units entering its respective PEO.

Issue:

The applicant did not provide a period when the analysis will be provided to the staff for review and approval. The LRA states that the analysis will be provided before PEO. In order for the staff to complete its review of such an analysis before PEO, adequate time needs to be provided for the review.

Request:

Please provide a period by which the analytical evaluation will be provided to the staff such that the staff will have adequate time to review it before Byron and Braidwood enters PEO.

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

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