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10 CFR 50
10 CFR 51
10 CFR 54

RS-13-285

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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Braidwood Station, Units 1 and 2
Facility Operating License Nos. NPF-72 and NPF-77
NRC Docket Nos. STN 50-456 and STN 50-457

Byron Station, Units 1 and 2
Facility Operating License Nos. NPF-37 and NPF-66
NRC Docket Nos. STN 50-454 and STN 50-455

Subject: Updated Responses to two NRC Requests for Additional Information from Set 1, dated October 7, 2013, related to the Braidwood Station, Units 1 and 2 and Byron Station, Units 1 and 2 License Renewal Application

References:

1. Letter from John W. Daily (NRC) to Michael P. Gallagher (Exelon), dated October 7, 2013, "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 1 (TAC NOS. MF1879, MF1880, MF1881, AND MF1882)

2. Letter from Michael P. Gallagher to NRC Document Control Desk, dated November 5, 2013, "Response to NRC Requests for Additional Information, Set 1, dated October 7, 2013, related to the Braidwood Station, Units 1 and 2 and Byron Station, Units 1 and 2 License Renewal Application

In the Reference 1 letter, the NRC requested additional information from Exelon Generation Company, LLC (Exelon) related to the License Renewal Application (LRA) for the Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2 (BBS). In the Reference 2 letter, Exelon responded to this request.

As a result of interactions with the NRC staff during the recent Audit conducted at Braidwood Station, Exelon is providing an update to two of the RAI responses provided in the Reference 2 letter, associated with the Reactor Head Closure Stud Bolting aging management program.

Specifically, the responses to RAIs B.2.1.3-2 and B.2.1.3-3 are revised. The revised responses replace the original responses in their entirety.

The responses to RAIs B.2.1.3-1, B.2.1.5.2-1 and B.2.1.5.2-2, also provided in Reference 2, are not affected by this submittal and therefore stand as originally submitted.

Enclosure A contains the revised responses to these two requests for additional information related to the Reactor Head Closure Stud Bolting aging management program.

Enclosure B contains updates to sections of the LRA (except for the License Renewal Commitment List) affected by the responses.

Enclosure C provides an update to the License Renewal Commitment List (LRA Appendix A, Section A.5). There are no other new or revised regulatory commitments contained in this letter.

If you have any questions, please contact Mr. Al Fulvio, Manager, Exelon License Renewal, at 610-765-5936.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 12-19-2013

Respectfully,

Michael P. Gallagher
Vice President - License Renewal Projects
Exelon Generation Company, LLC

Enclosures: A: Response to Requests for Additional Information
B: Updates to affected LRA sections
C: License Renewal Commitment List Changes

cc: Regional Administrator – NRC Region III
NRC Project Manager (Safety Review), NRR-DLR
NRC Project Manager (Environmental Review), NRR-DLR
NRC Senior Resident Inspector, Braidwood Station
NRC Senior Resident Inspector, Byron Station
NRC Project Manager, NRR-DORL-Braidwood and Byron Stations
Illinois Emergency Management Agency - Division of Nuclear Safety

Enclosure A

Byron and Braidwood Stations (BBS), Units 1 and 2
License Renewal Application
Update to Responses to Requests for Additional Information

The responses contained in this enclosure replace the responses provided previously in Exelon letter RS-13-247 dated November 5, 2013. These responses replace the original responses in their entirety.

Updated (Replacement) Responses:

RAI B.2.1.3-2
RAI B.2.1.3-3

RAI B.2.1.3-2, BBS Closure Stud OE may not be bounded by GALL Report OE

Applicability:
Byron and Braidwood Stations, all units

Background:
LRA Section AMP B.2.1.3 "Reactor Head Closure Stud Bolting" states that the aging management program (AMP) will be consistent with the ten elements of AMP XI.M3, "Reactor Head Closure Stud Bolting," specified in NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," with an exception and an enhancement to the "preventive measures" program element.

The Abstract in Chapter XI of the GALL Report states, "if an applicant takes credit for a program in the GALL Report, it is incumbent on the applicant to ensure that the conditions and operating experience at the plant are bounded by the conditions and operating experience for which the GALL Report program was evaluated. If these bounding conditions are not met, it is incumbent on the applicant to address the additional effects of aging and augment the GALL Report aging management program(s) as appropriate." The staff performed a search of operating experience and noted that Byron, Unit 2 (with the exception of Braidwood, Unit 2), is the only pressurized-water reactor plant that is operating with an inoperable (un-tensioned) closure stud and the only one that has a stud left in place and inoperable.

Issue:
The applicant's discussion of plant-specific operating experience regarding its closure stud does not fully address how the applicant's plant-specific operating experience is bounded by industry operating experience as considered in AMP XI.M3 of the GALL Report. The staff noted that LRA AMP B.2.1.3, "Reactor Head Closure Stud Bolting," may not be applicable, and a plant-specific AMP may be necessary in light of the plant-specific operating experience.

Request:
Justify how the plant-specific operating experience is bounded by the industry operating experience as considered in AMP XI.M3 of the GALL Report. As alternatives, either provide revisions to your AMP with associated reasoning, or provide a plant-specific AMP to manage aging effects of the reactor vessel head closure studs during the period of extended operation.

Exelon Response (Replacement Response):

During the development of the Byron and Braidwood License Renewal Application, an operating experience review was performed for plant specific and industry operating experience. This included all documents referenced in NUREG 1801, Revision 2, XI.M3, "Reactor Head Closure Stud Bolting". The review concluded that the age-related operating experience at Byron and Braidwood is bounded by the operating experience evaluated in the GALL Report program. The 1991 event at Braidwood Unit 2 in which stud 35 became stuck and the 2010 event at Byron Unit 2 in which stud 11 became stuck were considered in the operating experience review. These events were concluded not to be due to aging (i.e., cracking due to stress corrosion cracking (SCC), intergranular stress corrosion cracking (IGSCC), or loss of material due to wear or corrosion). Particular attention was given to the aging affect of loss of material due to wear. NUREG 1801, Revision 2, explains: "Wear occurs in parts that experience intermittent relative motion, frequent manipulation, or in clamped joints where relative motion is not intended, but may occur due to a loss of the clamping force." Wear or galling caused by event driven physical

damage (e.g., due to human error) is not age-related degradation. Based on this guidance the two events were concluded not to be due to loss of material due to wear. Therefore, the age-related operating experience at Byron and Braidwood is considered bounded by the operating experience evaluated in the GALL Report program XI.M3. However, the GALL Report program XI.M3 may not have considered the plant-specific operating conditions at Byron Unit 2 and Braidwood Unit 2 (i.e., operating with 53 out 54 reactor head closure studs tensioned).

To address the current plant-specific operating conditions at Byron Unit 2 and Braidwood Unit 2, Exelon will repair Byron Unit 2 reactor head closure stud 11 and Braidwood Unit 2 reactor head closure stud 35 so that all 54 reactor head closure studs are tensioned during the period of extended operation (PEO). For Byron Unit 2, reactor head closure stud 11 will be removed. After reactor head closure stud 11 is removed, the reactor vessel flange stud hole threads will be inspected and, if a repair is required, the reactor vessel flange stud hole will be repaired in accordance with ASME Section III, 1971 Edition with Addenda through Summer 1973 requirements. At Braidwood Unit 2, reactor head closure stud 35 was removed in 2002 and the associated reactor vessel flange stud hole was damaged. Therefore, reactor vessel flange stud hole 35 will be repaired in accordance with ASME Section III, 1971 Edition with Addenda through Summer 1973 requirements. These repairs will be completed no later than 6 months prior to the PEO to provide time for the NRC to review completion of the repair activities prior to plant entry into the PEO.

As shown in Enclosure B of this letter, Byron and Braidwood LRA Appendix A, Section A.2.1.3 and Appendix B, Section B.2.1.3, are revised to delete the enhancement that was added in the original RAI response contained in letter RS-13-247, dated November 5, 2013, since the four Byron and Braidwood Units will each be operated with all 54 studs tensioned during the PEO. Correspondingly, the following revisions to Byron and Braidwood LRA Table A.5 Commitment List are being made as shown in Enclosure C of this letter: 1) Item 3 has been revised to delete enhancement 2, which was added in the original RAI response contained in letter RS-13-247, dated November 5, 2013; 2) Item 47 has been added to capture the new commitment to repair Byron Unit 2 stud 11; and 3) Item 48 has been added to capture the new commitment to repair Braidwood Unit 2 stud 35.

The Reactor Head Closure Stud Bolting (B.2.1.3) aging management program is a preventive and condition monitoring program that manages aging due to cracking and loss of material of all reactor head closure studs and associated components. Byron and Braidwood perform volumetric examinations of the threads of reactor head closure studs and stud holes in accordance with ASME Section XI. Any discontinuities or flaws are entered in the Corrective Action Program for evaluation and corrective action. Therefore, since all 54 Byron Unit 2 and Braidwood Unit 2 reactor head closure studs will be tensioned during plant operation during the PEO, the Reactor Head Closure Stud Bolting (B.2.1.3) aging management program is appropriate to ensure adequate aging management of the reactor head closure studs and associated components during the PEO.

Exelon's previous response to RAI B.2.1.3-2 in letter RS-13-247, dated November 5, 2013 contained an error. In that response, Exelon stated: *"After each stud is removed from the reactor vessel flange stud hole, each hole is cleaned, inspected, lubricated, and plugged prior to reactor cavity flood-up… including the Braidwood Unit 2 reactor vessel flange stud 35 hole".* However, contrary to this statement, the Braidwood Unit 2 reactor vessel flange stud hole 35 is not lubricated and plugged prior to reactor cavity flood-up. This misstatement was due to a misinterpretation of the reactor closure head removal and installation procedures and applies only to Braidwood Unit 2 reactor closure head stud 35. This issue does not apply to Byron Unit

2 stuck stud 11 because the stud was not removed from the stud hole. This issue has been entered into the corrective action program.

Not lubricating or plugging Braidwood Unit 2 reactor vessel flange stud hole 35 prior to reactor cavity flood-up is inconsequential with respect to boric acid corrosion and foreign material intrusion. The reactor vessel flange stud hole 35 is cleaned and inspected prior to reactor vessel flood-up, and reactor vessel flange stud hole 35 is cleaned, inspected, and borated water is removed after the reactor cavity is drained. These specific aging management requirements are identified in the reactor closure head removal and installation procedures and require signoff. These procedures steps apply to each reactor vessel flange hole, including stud hole 35. The completed reactor closure head removal and installation work order from the most recent Braidwood Unit 2 refueling outage, in October 2012, was reviewed. Loss of material, cracking, or foreign material was not reported for any reactor vessel flange stud hole, including location 35.

RAI B.2.1.3-3, Byron Unit 2 Rx Closure stud 11, flange hole, and boric acid

Applicability:
Byron, Unit 2

Background:
During the audit when discussing the stuck Stud No. 11, the staff noted that the threads are not leak-tight and borated water may enter into the flange hole bottom space during refueling outages. The staff also noted that the boric acid concentration may continually increase following each refueling outage and subsequent plant heat-up.

Issue:
Due to the stuck Stud No. 11 being stuck and left in place, the conditions at the location for the flange hole and the stuck stud are unknown. As a result, accelerated boric acid corrosion could occur and may go undetected.

Request:
Discuss the condition of Stud No. 11 and the flange hole. Explain how the AMP will detect and monitor boric acid corrosion for the stud and flange-hole.

Exelon Response (Replacement Response):
The current configuration of Byron Unit 2 reactor head closure stud 11 and the associated reactor vessel flange stud hole is described in the response to RAI B.2.1.3-1. In 2010, after stud 11 became stuck, an Engineering evaluation was performed authorizing a configuration change in which 53 of 54 reactor head closure studs are required to be tensioned for plant operation. The supporting calculations concluded that the configuration meets the requirements of ASME Section III, 1971 Edition with Addenda through Summer 1973.

Because it has not yet been repaired, Stud 11 is subjected to an environment of borated water during refueling outages when the reactor cavity is flooded. Therefore, there is the potential that borated water will migrate through the space between the reactor vessel flange threads and the stud threads and accumulate in the volume under the stud. The potential for boric acid corrosion in these areas has been evaluated and it has been concluded that the potential material loss prior to the period of extended operation is insignificant and is bounded by a previous analysis. The evaluation indicates that the total accumulated material loss prior to the period of extend operation, assuming the corrosion began in 2010, is estimated to be less than 33 mils. The evaluation considers the effect of increased boric acid concentrations in subsequent refueling outages. The conclusion can be made primarily due to the small amount of time in which these areas may be exposed to borated water (i.e., only during refueling outages). An analysis performed in support of the attempted restoration of Braidwood Unit 2 stud 35 concluded that the radius of the associated reactor vessel flange hole can be increased by 375 mils and still meet the requirements of ASME Section III, 1971 Edition with Addenda through Summer 1973. The design requirements for Braidwood Unit 2 reactor vessel and Byron Unit 2 reactor vessel are identical. Therefore, the postulated radius increase of 33 mils in the Byron Unit 2 stud 11 reactor vessel flange hole prior to the period of extend operation is considered insignificant and bounded by the previous Braidwood Unit 2 reactor vessel flange hole analysis.

The updated response to RAI B.2.1.3-2 documents a new Exelon commitment that will ensure that Byron Unit 2 will operate with all 54 reactor head closure studs tensioned during the period

of extended operation (PEO). For Byron Unit 2, reactor head closure stud 11 will be removed. After stud 11 is removed, the reactor vessel flange stud hole threads will be inspected and, if a repair is required, the reactor vessel flange stud hole will be repaired in accordance with ASME Section III, 1971 Edition with Addenda through Summer 1973. These repairs will be completed no later than 6 months prior to the PEO to provide time for the NRC to review completion of the repair activities prior to plant entry into the PEO.

The Byron Unit 2 stuck stud 11 will be removed and repaired prior to the PEO. Therefore, for the period of extended operation, the condition of the reactor vessel flange stud hole will be known since the area will be accessible for inspection during refueling outages. In addition, the Reactor Head Closure Stud Bolting (B.2.1.3) aging management program provides for activities such as volumetric examinations of the threads of reactor head stud and stud holes in accordance with ASME Section XI to detect aging due to cracking and loss of material during the period of extended operation.

Enclosure B

Byron and Braidwood Stations, Units 1 and 2
License Renewal Application (LRA) updates resulting from the updated responses to the following RAI:

RAI B.2.1.3-2

Note: To facilitate understanding, portions of the original LRA text and changes to LRA sections made previously in Exelon letter RS-13-247 dated November 5, 2013 are shown in normal font. Changes made as a result of this submittal are shown with ***bolded italics*** for inserted text and ~~strikethroughs~~ for deleted text.

As a result of changes to the Reactor Head Closure Stud Bolting aging management program identified in the updated response to RAI B.2.1.3-2, LRA Appendix A, Section A.2.1.3, page A-11 is revised as shown below. These changes supersede the changes made in letter RS-13-247, dated November 5, 2013. Revisions are indicated with ***bolded italics*** for inserted text and ~~strikethroughs~~ for deleted text.

A.2.1.3 Reactor Head Closure Stud Bolting

The Reactor Head Closure Stud Bolting aging management program is an existing preventive and condition monitoring program that provides for preventive and condition monitoring activities to manage reactor head closure studs and associated RPV head flange threads, nuts, and washers for cracking and loss of material. The program is implemented through station procedures based on the examination and inspection requirements specified in ASME Code, Section XI, Table IWB-2500-1 and preventive measures to mitigate cracking. The program also relies on recommendations to address reactor head stud bolting aging-related degradation delineated in NUREG-1339 and NRC Regulatory Guide 1.65.

The Reactor Head Closure Stud Bolting aging management program will be enhanced to:

1. Revise the procurement requirements for reactor head closure stud material to assure that the maximum yield strength of replacement material is limited to a measured yield strength less than 150 ksi.

~~2. Take the following actions to address reactor head closure studs that are not removed from the reactor vessel flange when the reactor cavity is flooded and are therefore exposed to borated water:~~

~~a. Revise the reactor vessel disassembly procedures to require ultrasonic examinations of the area around the reactor vessel flange stud hole once each ISI program period in accordance with the methodology in ASME Section XI, Table IWB-2500-1, item number B6.40 and examination requirement IWB-2500-12.~~

~~b. When a reactor head closure stud is removed from the reactor vessel flange, then prior to placing the stud back in service:~~

~~1. Inspect the area around the reactor vessel flange hole in accordance with ASME Section XI, Table IWB-2500-1, and~~

~~2. Inspect the stud, nut, and washer in accordance with ASME Section XI Table IWB-2500-1 or install a new stud, nut, and washer.~~

~~These~~***This*** enhancement will be implemented prior to the period of extended operation.

As a result of the updated response to RAI B.2.1.3-2 provided in Enclosure A of this letter, the Reactor Head Closure Stud Bolting aging management Program Description, Exceptions to NUREG-1801, and Enhancements sub-sections of LRA Section B.2.1.3 on page B-28 through B-31 are revised as shown below. These changes supersede the changes made in letter RS-13-247, dated November 5, 2013. Revisions are indicated with ***bolded italics*** for inserted text and ~~strikethroughs~~ for deleted text.

B.2.1.3 Reactor Head Closure Stud Bolting

Program Description

The Reactor Head Closure Stud Bolting aging management program is an existing preventive and condition monitoring program which credits ASME Code, Section XI inspections of reactor head closure studs and associated RPV head flange threads, nuts, and washers for cracking and loss of material. The Reactor Head Closure Stud Bolting aging management program manages aging effects of an air with borated water leakage environment. The program is based on the examination and inspection requirements specified in the ASME Section XI Code, Subsection IWB, Table IWB-2500-1, and preventive measures described in NRC NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure of Nuclear Power Plants"; and NRC Regulatory Guide 1.65, “Materials and Inspection for Reactor Vessel Closure Studs.”

The current Byron and Braidwood ISI program plans for the third ten-year inspection interval are based on the 2001 Edition of the ASME Code, Section XI, through the 2003 addenda. The future 120-month inspection intervals will incorporate the requirements specified in the version of the ASME Code incorporated into 10 CFR 50.55a, 12 months before the start of the inspection interval. The Reactor Head Closure Stud Bolting aging management program implements ASME Code, Section XI inspection requirements through the ISI program plan. The inspections monitor for cracking, loss of material, and reactor coolant leakage. The program uses visual and volumetric examinations in accordance with the requirements of Section XI, Subsection IWA-2000. The Reactor Head Closure Stud Bolting aging management program was developed in accordance with the requirements detailed in the ASME Code, Section XI, Division 1, Subsection IWB, and Table IWB-2500-1.

ASME Code, Section XI allows for a number of examination methods to be used for volumetric and visual inspections. The RPV head flange threads and studs receive a volumetric examination and the surfaces of nuts and washers are inspected using a VT-1 examination. All pressure-retaining boundary components in Examination Category B-P receive a visual VT-2 examination during the system leakage test and the system hydrostatic test. The extent and schedule for examining and testing the reactor head closure studs and associated RPV head flange threads, nuts, and washers is specified in Table IWB-2500-1 for Examination Category B-G-1 components, “Pressure Retaining Bolting Greater than 2 Inches in Diameter.”

Indications and relevant degraded conditions detected during examinations are evaluated in accordance with ASME Code, Section XI Subsection IWB-3100 for Class 1 components by comparing ISI results with the acceptance standards of IWB-3400 and IWB-3500. Specifically, flaw indications or relevant degraded conditions are evaluated in accordance with IWB-3515 or IWB-3517 as indicated in Table IWB-2500-1 and Table 3410-1 of ASME Code, Section XI. These monitoring methods are effective in detecting cracking and loss of materials and the frequency of monitoring is adequate to prevent significant age-related degradation.

The reactor head closure studs are constructed of ASME Code, SA540, Class 3, Grade B23 material, which has a maximum tensile strength of less than 170 ksi, which complied with Reg Guide 1.65, Revision 0 that was in effect during plant construction. The Reactor Head Closure Stud Bolting aging management program utilizes preventive measures to mitigate cracking described in Reg Guide 1.65, which includes the use of approved corrosion inhibitors and lubricants. The reactor head closure studs, nuts, and washers are fabricated with an acceptable phosphate coating to inhibit corrosion. In addition, a stable lubricant that does not contain molybdenum disulfide is applied to the threads prior to reactor vessel head re-installation.

Currently, Byron Unit 2 stud 11 and Braidwood Unit 2 stud 35 are not in-service because they are not tensioned during operation. ~~In addition, t~~***T***he configuration of the reactor vessel in-service studs, nuts, and washers is designed to allow them to be completely removed during each refueling outage and placed in storage racks on the containment operating deck. ~~The stud holes in the RPV head flange are sealed with special plugs before removing the reactor head. Thus, the bolting materials and stud holes are not exposed to the borated refueling cavity water.~~ ***Therefore, in-service studs, nuts, and washers are not exposed to the borated refueling cavity water.***

Also, in-service reactor vessel flange stud holes are sealed with plugs before the reactor cavity is flooded with borated water. After the reactor cavity is drained, borated water is removed from the areas above the plugs, the plugs are removed, and the reactor vessel flange holes are inspected. If any borated water has leaked past the plugs, the borated water is removed and the holes are cleaned. The out-of-service Braidwood Unit 2 reactor vessel flange stud hole 35, which is not plugged, is cleaned and inspected prior to reactor vessel flood-up. In addition, Braidwood Unit 2 reactor vessel flange stud hole 35 is cleaned, inspected, and borated water is removed after the reactor cavity is drained. Therefore, exposure of accessible reactor vessel flange holes to borated water is minimized.

As shown in Appendix A, Table A.5, License Renewal Commitment List, items 47 and 48, Byron Unit 2 reactor head closure stud location 11 and Braidwood Unit 2 reactor head closure stud location 35 will be repaired so that all 54 reactor head closure studs will be in-service and managed as described above during the period of extended operation.

~~Operating experience has shown that occasionally reactor head closure studs become stuck and are not removed from the reactor cavity during refueling outages. Under these conditions, surfaces of the stud above the vessel flange are exposed to borated water and surfaces of the stud inside the reactor vessel flange hole and surfaces of the flange hole may be subjected to a borated water environment. Therefore, an enhancement has been added to the Reactor Head Closure Stud Bolting aging management program to address reactor head closure studs that are not removed from the reactor cavity when flooded during a refueling outage.~~

NUREG-1801 Consistency

The Reactor Head Closure Stud Bolting aging management program will be consistent with the ten elements of aging management program XI.M3, "Reactor Head Closure Stud Bolting," specified in NUREG-1801 with the following exception:

Exceptions to NUREG-1801

1. NUREG-1801 requires, as a preventive measure that can reduce the potential for SSC or IGSCC, using bolting material for the reactor head closure studs that have an actual measured yield strength limited to less than 1,034 megapascals (MPa) (150 kilo-pounds per square inch) (NUREG-1339). Site documentation indicates that some reactor head closure studs installed prior to commercial operation, or used as replacements, may have actual measured yield strength that is greater than 150 ksi. **Program Element Affected: Preventive Measures (Element 2)**

   Justification for Exception

   NUREG-1801 provides guidance to use bolting material for reactor head closure studs that has an actual measured yield strength limited to less than 150 ksi as delineated in NUREG-1339 and Reg Guide 1.65 Revision 1, which describes SA 540, Class 3, Grade B23 as high-strength, low alloy material that when tempered to a maximum tensile strength of less than 170 ksi, is relatively immune to stress corrosion cracking. However, Reg Guide 1.65, Revision 1 recommends that design conservatism should be exercised in determining the sizing of the studs so that the strength level of the material selected will not result in a measured yield strength exceeding 150 ksi. This design conservatism was not recommended in Reg Guide 1.65, Revision 0.

   The Byron and Braidwood reactor vessel head closure studs were designed. fabricated, and examined in accordance with the requirements of ASME Boiler and Pressure Vessel Code, Section III, Summer 1973 Addenda and 10 CFR 50, Appendix G (July 1973, Paragraph IV.A.4). The reactor head closure studs were fabricated from SA 540, Class 3, Grade B23 alloy steel with a minimum yield strength of 130 ksi, a minimum tensile strength of 145 ksi, and a maximum tensile strength of

170 ksi. Relative to material strength, the studs are in compliance with Reg Guide 1.65, Revision 0, which was current during plant construction. The maximum reported measured yield strength documented in the UFSAR for Byron or Braidwood is 153 ksi which is slightly greater than NUREG-1801 criteria for actual measured yield strength of 150 ksi. Therefore, the installed studs were consistent with the existing regulatory guidance when installed (Reg Guide 1.65, Revision 0), and per the guidance in Reg Guide 1.65, Revision 1, are relatively immune to stress corrosion cracking.

In addition, the reactor vessel in-service studs, nuts, and washers are removed during each refueling outage and placed in storage racks on the containment operating deck. ~~The stud holes in the RPV head flange are sealed with special plugs before removing the reactor head. Thus, the bolting materials and stud holes are not exposed to the borated refueling cavity water during refueling outages.~~ ***Therefore, in-service studs, nuts, and washers are not exposed to the borated refueling cavity water.***

All other preventive measures listed in NUREG-1801 program XI.M3, "Reactor Head Closure Stud Bolting" that can reduce the potential for cracking are met by the Reactor Head Closure Stud Bolting aging management program. These include:

a) Metal-plated stud bolting is not used, which could cause degradation due to corrosion or hydrogen embrittlement.

b) A phosphate surface treatment was applied to the studs, nuts, and washers during fabrication to inhibit corrosion.

c) An approved stable lubricant is applied to the studs whenever the reactor head is reinstalled. The lubricant used does not contain molybdenum disulfide (MoS2) which has been shown to be a potential contributor to SCC.

Since the actual measured yield strength of some installed studs may be greater than 150 ksi, the aging management review identified the stud material as “High Strength Low Alloy Steel Bolting with Yield Strength of 150 ksi or Greater” and identified cracking as an aging effect requiring management. The closure studs are volumetrically (UT) examined per ASME Code, Section XI, Table IWB-2500-1, Category BG-1, which is appropriate for identifying cracking. There have been no recordable indications identified by ISI program examination of reactor head closure stud bolting components, indicating that the current program has been effective in managing cracking. An additional preventive measure has been implemented to revise the purchasing requirements for reactor head closure stud material to assure that any studs procured in the future will have measured yield strength of less than 150 ksi. Therefore, the Reactor Head Closure Stud Bolting aging management program will be

effective in managing the cracking aging effect during the period of extended operation.

Enhancements

Prior to the period of extended operation, the following enhancements will be implemented in the following program elements:

1. Revise the procurement requirements for reactor head closure stud material to assure that the maximum yield strength of replacement material is limited to a measured yield strength less than 150 ksi. **Program Element Affected: Preventive Actions (Element 2) and Corrective Actions (Element 7)**.

2. Take the following actions to address reactor head closure studs that are not removed from the reactor vessel flange when the reactor cavity is flooded and are therefore exposed to borated water:

   a. Revise the reactor vessel disassembly procedures to require ultrasonic examinations of the area around the reactor vessel flange stud hole once each ISI program period in accordance with the methodology in ASME Section XI, Table IWB-2500-1, item number B6.40 and examination requirement IWB-2500-12.

   b. When a reactor head closure stud is removed from the reactor vessel flange, then prior to placing the stud back in service:

      1. Inspect the area around the reactor vessel flange hole in accordance with ASME Section XI, Table IWB-2500-1, and

      2. Inspect the stud, nut, and washer in accordance with ASME Section XI Table IWB-2500-1 or install a new stud, nut, and washer.

   Program Element Affected: Preventive Actions (Element 2), Parameters Monitored/Inspected (Element 3), and Detecting Aging Effects (Element 4).

Enclosure C

Byron and Braidwood Stations (BBS) Units 1 and 2
License Renewal Commitment List Changes

This Enclosure identifies commitments made in this document and is an update to the Byron and Braidwood Station (BBS) LRA Appendix A, Table A.5 License Renewal Commitment List. Any other actions discussed in the submittal represent intended or planned actions and are described to the NRC for the NRC's information and are not regulatory commitments. Changes to the BBS LRA Appendix A, Table A.5 License Renewal Commitment List are as a result of the Exelon response to the following RAI:

RAI B.2.1.3-2

Notes:

- To facilitate understanding, portions of the original License Renewal Commitment List have been repeated in this Enclosure, with revisions indicated.
- Existing LRA text is shown in normal font. Changes are highlighted with ***bold italics*** for inserted text and ~~strikethroughs~~ for deleted text.

As a result of the updated response to RAI B.2.1.3-2 provided in Enclosure A of this letter, LRA Appendix A, Table A.5 License Renewal Commitment List, line item 3 on page A-70 is revised to delete enhancement 2 as shown below. In addition, as a result of the updated response to RAI B.2.1.3-2 provided in Enclosure A of this letter, new commitments, lines item 47 and 48, are added as shown below. The "SOURCE" column is updated to document the associated Exelon correspondence information. Any other actions described in this submittal represent intended or planned actions. They are described for the NRC's information and are not regulatory commitments.

A.5 License Renewal Commitment List

NO.	PROGRAM OR TOPIC	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
3	Reactor Head Closure Stud Bolting	Reactor Head Closure Stud Bolting is an existing program that will be enhanced to: 1. Revise the procurement requirements for reactor head closure stud material to assure that the maximum yield strength of replacement material is limited to a measured yield strength less than 150 ksi. ~~2. Take the following actions to address reactor head closure studs that are not removed from the reactor vessel flange when the reactor cavity is flooded and are therefore exposed to borated water:~~ ~~a. Revise the reactor vessel disassembly procedures to require ultrasonic examinations of the area around the reactor vessel flange stud hole once each ISI program period in accordance with the methodology in ASME Section XI, Table IWB-2500-1, item number B6.40 and examination requirement IWB-2500-12.~~ ~~b. When a reactor head closure stud is removed from the reactor vessel flange, then prior to placing the stud back in service:~~ ~~1. Inspect the area around the reactor vessel flange hole in accordance with ASME Section XI, Table IWB-2500-1, and~~ ~~2. Inspect the stud, nut, and washer in accordance with ASME Section XI Table IWB-2500-1 or install a new stud, nut, and washer.~~	Program to be enhanced prior to the period of extended operation.	Section A.2.1.3 Exelon letter RS-13-247 RAI B.2.1.3-2 ***11/5/2013*** ***Exelon letter RS-13-285 RAI B.2.1.3-2 updated response 12/19/2013***

A.5 License Renewal Commitment List (continued)

NO.	PROGRAM OR TOPIC	COMMITMENT	IMPLEMENTATION SCHEDULE	SOURCE
47	*Byron Unit 2 Reactor Head Closure Stud Configuration (Byron only)*[Note 3]	*Byron Unit 2 reactor head closure stud location 11 will be repaired so that all 54 reactor head closure studs are tensioned during the period of extended operation.*	*No later than 6 months prior to the period of extended operation.*	*Exelon letter RS-13-285 RAI B.2.1.3-2 updated response*
48	*Braidwood Unit 2 Reactor Head Closure Stud Configuration (Braidwood only)*[Note 3]	*Braidwood Unit 2 reactor head closure stud location 35 will be repaired so that all 54 reactor head closure studs are tensioned during the period of extended operation.*	*No later than 6 months prior to the period of extended operation.*	*Exelon letter RS-13-285 RAI B.2.1.3-2 updated response*