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RS-15-067

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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: LRA Amendment Providing Commitment for Control Rod Drive Mechanism Examinations, related to the Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2, License Renewal Application

References: 1. Letter from Michael P. Gallagher, Exelon Generation Company LLC (Exelon) to NRC Document Control Desk, dated May 29, 2013, "Application for Renewed Operating Licenses"

2. Letter from John W. Daily, US NRC to Michael P. Gallagher, Exelon, dated December 12, 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 4 (TAC NOS. MF1879, MF1880, MF1881, AND MF1882)"

3. Letter from Michael P. Gallagher, Exelon Generation Company LLC (Exelon) to NRC Document Control Desk, dated January 13, 2014, "Response to NRC Requests for Additional Information, Set 4, dated December 12, 2013, related to the Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2 License Renewal Application"

4. Letter from Lindsay R. Robinson, US NRC to Michael P. Gallagher, Exelon, dated June 4, 2014, "Request for Additional Information for the Review of the Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2, License

Renewal Application, Set 29 (TAC NOS. MF1879, MF1880, MF1881, and MF1882)”

5. Letter from Michael P. Gallagher, Exelon to NRC Document Control Desk, dated June 18, 2014, “Responses to NRC Requests for Additional Information, Set 29, dated June 4, 2014, related to the Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2, License Renewal Application”

6. Letter from Michael P. Gallagher, Exelon, to NRC Document Control Desk, dated November 24, 2014, “Update Associated with Earlier Responses to Set 29 RAI B.2.1.5-1a, related to the Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2, License Renewal Application”

7. Letter from Michael P. Gallagher, Exelon, to NRC Document Control Desk, dated January 28, 2015, “LRA Impact Assessment Associated with Earlier Responses to Set 29 RAI B.2.1.5-1a, related to the Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2, License Renewal Application”

In Reference 1, Exelon Generation Company, LLC (Exelon) submitted the License Renewal Application (LRA) for the Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2 (BBS). In Reference 2, the NRC staff (Staff) requested, in part, information related to loss of material in Control rod drive mechanism (CRDM) nozzles due to wear caused by interaction with thermal sleeve centering pads. Reference 3 described Exelon’s plan to manage the loss of material aging effect through the period of extended operation with a bounding analysis that would obviate the need for CRDM nozzle examinations.

In Reference 4, the Staff requested additional details regarding the analysis, the results and any necessary updates to the LRA. In Reference 5, Exelon further described the analysis, which was being performed as part of an industry owner’s group project, and informed the Staff that the results of the detailed analysis would be communicated to the Staff in November 2014. Reference 6 provided the Staff with a summary of the completed CRDM housing wear analysis. Reference 7 provided the Staff with an update regarding the LRA impact of the CRDM housing wear analysis, and included a commitment (Commitment 49) to incorporate the analysis into the Byron and Braidwood Stations’ licensing basis no later than six months prior to the period of extended operation.

Exelon and the NRC Staff held a telephone conference on January 29, 2015 to discuss a draft RAI on this topic. As discussed in that teleconference, Exelon informed the Staff of its intent to submit an amendment to the LRA that would commit Byron and Braidwood Stations to performing certain examinations of the CRDM housings, in lieu of answering additional questions pertaining to the CRDM housing wear analysis. The Staff agreed to evaluate the proposed LRA amendment, upon submittal by Exelon, and refrain from issuing an RAI at this time.

This letter is the LRA amendment referred to in the January 29, 2015 teleconference. Enclosure A describes the nature of the amendment and Enclosure B provides mark-ups showing the impact of this amendment on the LRA.

Enclosure C provides an update to LRA Appendix A, Section A.5, License Renewal Commitment List. License Renewal Commitment 1 is modified to add Enhancement 2, which describes the CRDM housing penetration examinations that are being added. Commitment 49, made in Reference 7, is deleted as it is no longer necessary, due to the added commitment to perform CRDM housing penetration examinations.

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 02-11-2015

Respectfully,



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

- Enclosures: A. Description of LRA Amendment to Perform Control Rod Drive Mechanism Housing Wear Examinations
- B. Byron and Braidwood Stations (BBS), Units 1 and 2, License Renewal Application Updates Associated with CRDM Housing Examination Amendment
- C. Byron and Braidwood Stations (BBS), Units 1 and 2, License Renewal Commitment List Update

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

Description of LRA Amendment to Perform Control Rod Drive Mechanism Housing Wear Examinations

Background

In Reference 6 of this letter, Exelon provided the NRC Staff with a summary of the results of a detailed analysis that was performed for the Byron and Braidwood Stations, Units 1 and 2, associated with control rod drive mechanism (CRDM) nozzle (housing) wear caused by interaction with the associated thermal sleeve centering tabs (tab depth is 0.1075 inch). This analysis demonstrated that the ASME Code acceptance criteria were met for the hypothetical maximum potential CRDM housing thermal sleeve centering tab wear depth of 0.1075 inches. To confirm that the analysis bounds the actual condition in the plant, Exelon is amending the LRA to include a commitment to measure the wear depth on several CRDM housings. This new commitment is provided in Enclosure C of this letter. In addition, LRA Appendices A and B are updated to include this new enhancement to examine the CRDM housing wear area, as part of the ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD aging management program. Also shown in Enclosure C is that Commitment 49, made in Exelon letter RS-15-049 to incorporate the CRDM housing wear analysis into the Byron and Braidwood Stations' licensing basis, is deleted as a result of the new commitment to perform the CRDM housing examinations.

This Enclosure provides details associated with the examination methodology, number and description of penetrations, and the basis for the frequency of examinations.

Examination Methodology

Ultrasonic testing (UT) examinations of the CRDM housing will be performed to determine the wear depth. Due to the narrow gap between the CRDM housing inner diameter and thermal sleeve (0.125 inches), the use of a blade probe is required to detect any indications within the CRDM housing. The examination methodology was qualified by demonstration in accordance with the EPRI/MRP program protocol (MRP-311, "Materials Reliability Program: Qualification Protocol for Pressurized Water Reactor Upper Head Penetration Ultrasonic Examinations," Revision 1). The examination method for detecting indications in the presence of wear and to measure the wear depth was developed using a UT technique with enhanced water coupling in the wear area. This technique was justified technically and demonstrated in the lab, and met the EPRI/MRP technical justification guidelines in accordance with EPRI/MRP-311 protocol for this configuration. The examination methodology utilizes time of flight diffraction (TOFD) techniques that are demonstrated to detect, locate, and size indications that initiate from either the inner diameter or outer diameter surfaces of the CRDM housing, as well as measuring the wear depth.

In order to evaluate the effectiveness of this UT technique in a different configuration due to the centering tab wear geometry, a mockup was fabricated from Alloy 600 material to replicate the centering tab wear geometry (Byron and Braidwood CRDM housings are made from Alloy 600 material). This mockup was constructed to include axial and circumferential electrical discharge machined notches within and adjacent to the centering tab wear areas to determine whether the technique was limited by a specific wear depth and to evaluate the effects centering tab wear

grooves would have on the ultrasonic leak path signature. The mockup also had carbon steel rings shrunk fit onto the CRDM housing outer diameter to simulate the reactor vessel head and CRDM housing interface.

With this UT technique, including enhanced water coupling in the wear area, the probe contact and water coupling efficiency are maintained with varying surface contours. The results of the testing confirmed the ability of the UT procedure to accurately detect indications within the wear interference region up to a wear depth of approximately 0.060 inches. Industry experience to date has shown that CRDM housing wear has not exceeded 0.030 inches. There is high confidence that this non-destructive examination technique is capable of detecting and measuring the wear depth and any other indications that could exist in the wear area.

Number and Description of Penetrations

There are thermal sleeves in 55 CRDM penetrations: 53 penetrations with control rod drive assemblies and two (2) penetrations with reactor vessel level instrumentation (RVLIS) for removable heated junction thermocouples, as communicated in the response to RAI B.2.1.5-2, in Exelon Letter RS-14-002. Only the five (5) centermost locations are accessible for wear examination using this UT technique due to the probe insertion length. In these five (5) center locations, the wear area is closest to the J-groove weld. As determined by industry analysis, the primary plus secondary stress intensity range in the CRDM housing is more limiting near the J-groove weld than anywhere else in the CRDM housing. In addition, the CRDM housing wear near the J-groove weld has greater susceptibility to PWSCC due to higher residual stresses. The wear in housing locations outside of the five centermost locations is located well above the critical PWSCC region. Therefore, the five (5) centermost CRDM housing penetrations on each unit are the most representative and leading locations for wear examinations because of the stress conditions and PWSCC susceptibility.

Basis for Frequency of Examinations

At Byron and Braidwood, the first indications were found in the 2011 refueling outages, when there was lift-off of the probe (which caused loss of signal) during the J-groove weld examinations on a few center penetrations in the wear area. Industry operating experience confirms the CRDM housing wear progresses slowly and is on the order of 0.020 to 0.030 inches after more than 25 years of plant operation. A ten-year examination frequency is considered reasonable based on the acceptance criteria for the potential maximum wear of 0.1075 inches and the CRDM housing wear depths that have been measured to date in the industry. The examinations will be performed at least once during the 10-year period prior to the period of extended operation, and on a 10-year frequency during the period of extended operation. These examinations, when performed, will be done in conjunction with CRDM nozzle examination activities to minimize the dose to the individuals performing the work.

Summary

Exelon will examine the five (5) centermost CRDM housing penetration wear areas on each unit using a non-destructive examination technique, which was technically justified and demonstrated in the lab. These examinations will be performed at least once during the 10-year period prior to the period of extended operation, and on a 10-year frequency during the period of extended operation. This enhancement to the ASME Section XI Inservice Inspection,

Subsections IWB, IWC, and IWD aging management program will ensure that potential wear from the thermal sleeve centering tabs does not compromise CRDM housing integrity during the period of extended operation.

Enclosure B

Byron and Braidwood Stations (BBS), Units 1 and 2, License Renewal Application Updates Associated with CRDM Housing Examination Amendment

Note: To facilitate understanding, the original LRA pages 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.

LRA Appendix A, Section A.2.1.1, ASME Code Section XI, Subsections IWB, IWC, and IWD aging management program is revised as shown below to incorporate a new enhancement to perform CRDM housing examinations. Revisions are indicated with ***bold italics*** for inserted text and ~~strikethroughs~~ for deleted text.

A.2.1.1 ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD

The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD aging management program is an existing condition-monitoring program that consists of periodic volumetric, surface, and/or visual examinations of ASME Class 1, 2, and 3 pressure-retaining components, including welds, pump casings, valve bodies, integral attachments, and pressure-retaining bolting for assessment, identification of signs of age-related degradation, and establishment of corrective actions. The program includes examinations and tests performed to identify and manage cracking, loss of fracture toughness, and loss of material in Class 1, 2, and 3 piping and components. This ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD aging management program is implemented in accordance with 10 CFR 50.55a and ASME Code, Section XI, and is supplemented by EPRI Maintenance Reliability Programs MRP-146, "Management of Thermal Fatigue in Normally Stagnant Non-Isolable Reactor Coolant Branch Lines" and MRP-192 (Braidwood only), "Assessment of RHR Mixing Tee Thermal Fatigue in PWR Plants." These activities include examinations, testing, detection, monitoring and trending, and evaluation of results to confirm that aging effects are managed during the period of extended operation.

The control rod drive mechanism (CRDM) thermal sleeves are examined under an augmented ISI inspection program. The scope of examination is to ultrasonically test (UT) the five (5) thermal sleeves with the worst wear on each unit. The plan for managing thermal sleeve wear is to obtain measured (UT) wear data points on each unit at the five (5) designated thermal sleeve reactor core locations during three (3) different outages. The frequency for inspection of the reactor vessel head thermal sleeve for loss of material due to wear will be re-evaluated after the accumulation of the three (3) data points on each of the five (5) designated thermal sleeves. The three (3) series of examinations will be performed prior to the period of extended operation. Subsequently, the required frequency for further inspections, if required, will be determined using the guidance provided in WCAP-16911-P, "Reactor Vessel Head Thermal Sleeve Wear Evaluation for Westinghouse Domestic Plants."

The ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD aging management program will be enhanced to:

1. Conduct a visual inspection of the accessible portions of the ASME Class 2 reactor vessel flange leakage monitoring tube every other refueling outage.
2. ***Perform non-destructive examination of the five (5) centermost CRDM housing penetrations to determine the thermal sleeve centering tab wear depth on the CRDM housing penetration inner diameter wall. On each unit, these CRDM housings will be examined at least once during the 10-year period prior to the period of extended operation, and on a 10-year frequency during the period of extended operation.***

These enhancements will be implemented prior to the period of extended operation. ***The CRDM housing penetration examinations will be performed in accordance with the schedule described above.***

LRA Appendix B, Section B.2.1.1, ASME Code Section XI, Subsections IWB, IWC, and IWD aging management program is revised as shown below to incorporate a new enhancement to perform CRDM housing examinations. Revisions are indicated with ***bold italics*** for inserted text.

B.2.1.1 ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD

Enhancements

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

1. Conduct a visual inspection of the accessible portions of the ASME Class 2 reactor vessel flange leakage monitoring tube every other refueling outage. **Program Elements Affected: Scope of Program (Element 1)**
2. ***Perform non-destructive examination of the five (5) centermost CRDM housing penetrations to determine the thermal sleeve centering tab wear depth on the CRDM housing penetration inner diameter wall. On each unit, the CRDM housings will be examined at least once during the 10-year period prior to the period of extended operation, and on a 10-year frequency during the period of extended operation. Program Elements Affected: Scope of Program (Element 1), Parameters Monitored/Inspected (Element 3), Detection of Aging Effects (Element 4), Monitoring and Trending (Element 5), Acceptance Criteria (Element 6)***

Enclosure C

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

This Enclosure provides an update to the Byron and Braidwood Stations (BBS), Units 1 and 2, LRA Appendix A, Section A.5 License Renewal Commitment List, documenting the new commitment to perform CRDM housing penetration examinations as part of the ASME Code Section XI, Subsections IWB, IWC, and IWD aging management program. In addition, Commitment 49, which was added in Exelon letter RS-15-049, is deleted. Text added to this commitment list is shown in ***bolded italics***. Text deleted from the commitment list is shown with ~~strikethroughs~~.

As a result of the commitment to perform CRDM housing penetration examinations as part of the ASME Code Section XI, Subsections IWB, IWC, and IWD aging management program, and of the deletion of Commitment 49, the following updates are made to the A.5 License Renewal Commitment List. Text inserted as a result of this update is shown in **bolded italics**; deleted text is shown with ~~strikethroughs~~, and existing LRA text is shown in normal font.

A.5 LICENSE RENEWAL COMMITMENT LIST

NO.	PROGRAM OR TOPIC	COMMITMENT	IMPLEMENTATION SCHEDULE*	SOURCE
1	ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD	<p>ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD is an existing program that will be enhanced to:</p> <ol style="list-style-type: none"> 1. Conduct a visual inspection of the accessible portions of the ASME Class 2 reactor vessel flange leakage monitoring tube every other refueling outage. 2. <i>Perform non-destructive examination of the five (5) centermost CRDM housing penetrations to determine the thermal sleeve centering tab wear depth on the CRDM housing penetration inner diameter wall. On each unit, these CRDM housings will be examined at least once during the 10-year period prior to the period of extended operation, and on a 10-year frequency during the period of extended operation.</i> 	<p>Program to be enhanced no later than six months prior to the period of extended operation.</p> <p><i>Pre-PEO inspections specified in Enhancement 2 will be completed either no later than six months prior to the PEO, or before the end of the last refueling outage prior to the PEO, whichever occurs later.</i></p>	<p>Section A.2.1.1</p> <p><i>Exelon letter RS-15-067 02/11/2015</i></p>

NO.	PROGRAM OR TOPIC	COMMITMENT	IMPLEMENTATION SCHEDULE*	SOURCE
49	CRDM Housing Wear Analysis	Incorporate the analysis performed in PWROG-14067-P, Revision 0, "Generic ASME Code Evaluation of a CRDM Housing with Inside Surface Wear" into the Byron and Braidwood Units 1 and 2 licensing basis. DELETED.	No later than six months prior to the period of extended operation. Not Applicable.	Exelon letter RS-15-049 01/28/2015 Exelon letter RS-15-067 02/11/2015