Commonwealth Edison Company
1400 Opus Place
Downers Grove, IL 60515-5701

February 5, 1997

ComEd

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attn: Document Control Desk

Subject: Response to Request for Additional Information Related to the Proposed Extension of the Byron 1 and Braidwood 1 3.0 Volt License Amendment for ODSCC

Byron Nuclear Power Station Unit 1
NRC Docket Number: 50-454

Braidwood Nuclear Power Station Unit 1
NRC Docket Number: 50-456

References:

1. H. Stanley letter to the Nuclear Regulatory Commission dated August 19, 1996, transmitting Request for Technical Specification Amendment Pertaining to the 3 Volt Renewal

2. M. Lynch letter to I. Johnson dated January 27, 1997, transmitting Request for Additional Information Related to the Proposed Extension of the Byron 1 and Braidwood 1 3.0 Volt License Amendment for ODSCC

Reference 1 transmitted the Commonwealth Edison Company (ComEd)'s request to renew the 3.0 Volt Interim Plugging Criteria for the Byron Unit 1 and Braidwood Unit 1 steam generators. Based upon that submittal, the Nuclear Regulatory Commission (NRC) issued a Request for Additional Information (RAI) which was transmitted via Reference 2. The Attachment contains ComEd's response to Questions 1 through 11. The response to Question 12 will be transmitted to the Staff at a later date.

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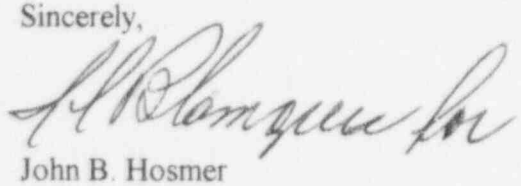
ComEd would like to bring to the Staff's attention an error in the August 19, 1996, submittal. In Attachment B, pages B-15 and B-21, ComEd included the requirement to inspect fifty tubes adjacent to each anti-rotation device in all four SGs along with twenty tubes along the patch plate seam in one SG, under the section of the submittal listing the Rotating Pancake Coil (RPC) scope. This is incorrect in that these tubes will be initially screened using the bobbin coil technique as developed under the EPRI Tube Support Plate Inspection Program. If indications are identified by bobbin, additional RPC inspections will be performed. This inspection approach is the same scope and technique used in support of the initial 3.0 volt IPC implementation at Braidwood 1 and Byron 1 in the Fall of 1995.

If you have any questions concerning this correspondence, please contact Denise M. Saccomando, Senior PWR Licensing Administrator at (630) 663-7283.

Sincerely,



John B. Hosmer
Engineering Vice President

Attachment

cc: D. Lynch, Senior Project Manager-NRR
G. Dick, Byron/Braidwood Project Manager-NRR
C. Phillips, Senior Resident Inspector-Braidwood
S. Burgess, Senior Resident Inspector-Byron
A. B. Beach, Regional Administrator-RIII
Office of Nuclear Safety-IDNS

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ATTACHMENT
REQUEST FOR ADDITIONAL INFORMATION
RELATED TO THE EXTENSION OF THE 3.0 VOLT LOWER VOLTAGE REPAIR LIMIT FOR ODSCC
BYRON UNIT 1 AND BRAIDWOOD UNIT 1
DOCKET NOS. STN 50-454 AND STN 50-456

1. Provide a summary of the results from the inspection of the steam generator (SG) internal structures conducted in the Byron 1 outage in October 1995, similar to the summaries provided in the two reports cited in the references below.

Response

A summary of the results from the inspection of the steam generator (SG) internal structures conducted in the mid-cycle outage at Byron 1 in October 1995 were provided to the NRC in Byron letter BYRON-96-0074 to the Office of Nuclear Reactor Regulation, dated March 19, 1996, "Byron Unit 1 Steam Generator Interim Plugging Criteria 90 Day Report." Attachment A of this letter, "Tube Support Plate Structural Integrity Verifications," contains a summary of the results. No indications of degradation of the internal structures were found.

2. The licensee stated in Reference 1 that it visually inspected 89 vertical support bars and 157 vertical support bar welds in the four SGs and found no indication of structural degradation in the welds which would prevent the support bars from performing their function. State whether any types of indications were found. If so, describe the natu . of these indications, including the number of such indications and their location and an evaluation of their potential effect on their structural capability of the vertical support bar welds.

Response

No indications of any type were found.

3. In Reference 1, the licensee stated that it inspected 50 tubes around each of the three antirotation devices and did not find any operationally-induced degradation of the tube support plates (TSPs). State whether any type of degradation was found. If so, describe the nature of the degradation, including the extent, the location, the probable cause and an evaluation of the effect on the structural capability of the TSPs.

Response

No type of degradation was found.

4. In its letter dated August 19, 1996, the licensee stated that it will use a modified eddy current inspection (ECI) technique to inspect 50 tubes adjacent to each antirotation device in all four SGs and to inspect 20 tubes along the patch plate seam in one SG. State when and where this inspection will be performed (e.g., during the upcoming refueling outages at Braidwood 1 and Byron 1).

Response

The inspection of the fifty tubes adjacent to each antirotation device and the twenty tubes along the patch plate seam will be performed during the upcoming refueling outage (A1R06) at Braidwood 1 and during the next refueling outage (B1R08) at Byron 1, unless SG replacement occurs during that outage.

5. State whether the presence of the TSP intersections will continue to be verified during SG ECIs.

Response

The presence of the Tube Support Plate (TSP) intersections will continue to be verified during all Interim Plugging Criteria (IPC) inspections at Braidwood 1 and Byron 1 until SG replacement. A voltage-based repair criteria for axial indications at the TSPs will not be applied to the replacement SGs.

6. In its letter dated August 19, 1996, the licensee stated that it will verify the integrity of the SG tube expansions at the TSP intersections for the 21 SG tubes used to stabilize the TSPs by inspecting 20 percent of these expansions. Additionally, this sample of SG tubes will also be inspected at the top of the tubesheet in the roll transition zone. State when and where this SG tube inspection will be performed (e.g., during the upcoming refueling outages at Braidwood 1 and Byron 1). Describe the criteria for selecting the initial inspection sample of SG tubes.

Response

The inspection to verify the integrity of the SG tube expansions and the top-of-the tubesheet for each of these expanded tubes will be performed during the upcoming A1R06 refueling outage at Braidwood 1 and during the upcoming B1R08 refueling outage at Byron 1, unless SG replacement occurs during that outage. Twenty percent of the total expansions will be inspected. Each tube selected for inspection will have all TSP expansions and the hot-leg top-of-tubesheet roll transition regions inspected by Plus Point as described below. Considering the similarity of the tubes selected for the expansion process between the SGs, the similarity of the operation between the SGs, and the need to remove the SG tube plug to inspect the expansions, the following selection criteria has been established:

- SGs representative of the total population of Outside Diameter Stress Corrosion Cracking (ODSCC) at TSPs and top of tubesheet indications
- Tubes from each of the fourteen bundle regions where TSP expansions were performed.
- Tubes containing both the minimum and maximum number of expansions per tube.

The current program for Braidwood 1 consists of inspecting the steam generators in loops A and D for the initial 20% sampling. These generators represent approximately 50% of the ODSCC at the TSPs and approximately 40% of the top-of-tubesheet indications to date. If inspections at Byron 1 are required prior to SG replacement, a similar selection process will be performed. The selection process will include a tube from each of the fourteen tube bundle regions where expansions were performed. This will provide a representative sampling of all variations on location and number of expansions per tube. If tooling limitations do not allow removal of a particular plug without personnel entry into the steam generator channel head, another tube will be selected.

The expansions will be examined by a method equivalent to or better than that used during the previous outages. This method will include the use of the EddyNet 95 software. The method used at Byron 1 and Braidwood 1 during the installation of the expansions used the ANSER software. The sleeve expansions at the TSPs will be examined using a Gimbaled Plus Point coil. The expansions at the top-of-tubesheet will be examined using the Plus Point probe. These inspection techniques are sensitive to axial and circumferential indications. If a circumferential crack like indication is identified at the TSP expansion or if a circumferential crack like indication is detected at the top of the tubesheet of a locked tube, the inspection program will be enlarged to include 100% of the locked tubes in each SG.

7. In its submittal dated August 19, 1996, the licensee also stated that the staff will not be notified if axial indications are detected at the sleeved and expanded joint intersections of the 21 SG tubes with the TSPs or at the TTS. Since these SG tubes were inspected before plugging and no indications were found, the staff requests that it be promptly notified if any type of indication is found in subsequent inspections of these locations.

Response

ComEd will notify the Staff prior to unit restart if either axial or circumferential indications are detected at the sleeve expanded joint or at the top-of-tubesheet. This is a requirement listed in Section 4.5.3 of the Safety Evaluation approving the original 3.0 Volt IPC dated November 9, 1995.

The August 19, 1996, submittal stated that axial indications at the top-of-tubesheet or at the TSP expansion will not result in a displacement of the TSP by more than 0.1 inches. Therefore, finding axial indications at the TSP expansion or at the top-of-tubesheet region will not require expansion of the inspection scope.

If circumferential indications are detected at either the sleeve expanded joint or top-of-tubesheet, an analysis will be done to determine the effect of these indications on TSP displacement. Repairs will be implemented to maintain TSP displacement less than or equal to 0.1 inch. Detection of circumferential indications will result in expanding the inspection to 100% of the tubes containing TSP expansions.

Selection of the original tubes for TSP locking required the tubes to be free of axial or circumferential indications at the top-of-tubesheet. Tubes containing axial ODSCC at the tube-to-TSP intersections were allowed to be selected for TSP locking candidates. Braidwood 1 contains three tube-to-TSP intersections with indications that were dispositioned as axial indications confined within the TSP intersection. At Byron 1, none of the tube-to-TSP intersections contained indications. The baseline inspection of the top-of-tubesheet region and sleeve expansion joints did not reveal any axial or circumferential indications other than the original, axial ODSCC at the tube-to-TSP intersections discussed above.

8. The licensee stated in its August 19, 1996 submittal, that it will continue to implement the criteria for eddy current probe wear recommended by the Nuclear Energy Institute (NEI). This approach requires that all indications greater than 75 percent of the lower voltage repair limit which were inspected with a worn probe, be re-inspected with a new probe. State whether Braidwood 1 and Byron 1 will continue to reinspect with a new probe after determining that significant probe wear exists, indications greater than 75 percent of 1.0 volt, even hot-leg intersections at which the 3.0 volt alternate repair criteria (ARC) is applied.

Response

Braidwood 1 and Byron 1 will use the alternate probe wear criteria (NEI criteria) which was submitted to the NRC in a letter on March 19, 1996, and implemented during the Byron 1, March 1996, inspection. Byron 1 and Braidwood 1 will reinspect all indications greater than 75 percent of the lower Voltage Repair limit (1.0 volt) including hot leg indications, for tubes inspected with probes which do not meet the probe wear criteria.

9. In its submittal dated August 19, 1996, the licensee stated that the probability of axial tensile failure will be calculated in accordance with the guidance in Generic Letter (GL) 95-05 and will combine this probability with the conditional probability of axial burst failure if any indications with a voltage greater than or equal to 15 volts are identified or if a large number of indications between ten and fifteen volts are identified. State the basis for specifying a limit of 15 volts. Indicate why there is an upper limit on this range. Define what constitutes a large number of indications, including the basis for this criterion.

Response

As stated in our August 19, 1996 submittal, the number of indications predicted at the end of cycle 7 between ten and fifteen volts for Braidwood 1 is 0.3 indications, and 4.59 indications at the end of cycle 9 for Byron 1. The maximum voltage predicted at the end of cycle 7 is 10.5 volts for Braidwood 1 and 13.5 volts at the end of cycle 9 for Byron 1. ComEd conservatively selected a limit of fifteen volts to require a probability of axial tensile burst failure calculation based on the following:

- The structural limit for axial tensile tearing is approximately 35 volts. ComEd has conservatively chosen a value less than half of this limit before requiring the calculation of the probability of burst contribution from axial tensile failure.
- The probability of axial tensile burst for a fifteen volt indication is extremely small, approximately 4×10^{-6}. An indication less than fifteen volts would add a negligible contribution to the total burst probability.
- Fifteen volts is higher than the maximum indication voltage predicted for the end of the next cycle of operation at both sites.

A small fraction of the 1×10^{-2} burst probability limit was selected as a goal for the contribution of indications greater than ten volts. A goal of 1×10^{-3} was selected. Given the probability of tensile rupture associated with a ten volt signal being 3×10^{-6}, it would take approximately 325 indications near ten volts before a probability of 1×10^{-3} is reached. Given the probability of tensile rupture associated with a fifteen volt signal being 4×10^{-6}, it would take approximately 250 indications near fifteen volts before a probability of 1×10^{-3} is reached.

Therefore, ComEd will not calculate the contribution due to the probability of axial tensile burst unless greater than 250 indications in the range of ten to fifteen volts are detected or unless an indication greater than fifteen volts is detected.

9. In its submittal dated August 19, 1996, the licensee stated that the probability of axial tensile failure will be calculated in accordance with the guidance in Generic Letter (GL) 95-05 and will combine this probability with the conditional probability of axial burst failure if any indications with a voltage greater than or equal to 15 volts are identified or if a large number of indications between ten and fifteen volts are identified. State the basis for specifying a limit of 15 volts. Indicate why there is an upper limit on this range. Define what constitutes a large number of indications, including the basis for this criterion.

Response

As stated in our August 19, 1996 submittal, the number of indications predicted at the end of cycle 7 between ten and fifteen volts for Braidwood 1 is 0.3 indications, and 4.59 indications at the end of cycle 9 for Byron 1. The maximum voltage predicted at the end of cycle 7 is 10.5 volts for Braidwood 1 and 13.5 volts at the end of cycle 9 for Byron 1. ComEd conservatively selected a limit of fifteen volts to require a probability of axial tensile burst failure calculation based on the following:

- The structural limit for axial tensile tearing is approximately 35 volts. ComEd has conservatively chosen a value less than half of this limit before requiring the calculation of the probability of burst contribution from axial tensile failure.
- The probability of axial tensile burst for a fifteen volt indication is extremely small, approximately 4×10^{-6}. An indication less than fifteen volts would add a negligible contribution to the total burst probability.
- Fifteen volts is higher than the maximum indication voltage predicted for the end of the next cycle of operation at both sites.

A small fraction of the 1×10^{-2} burst probability limit was selected as a goal for the contribution of indications greater than ten volts. A goal of 1×10^{-3} was selected. Given the probability of tensile rupture associated with a ten volt signal being 3×10^{-6}, it would take approximately 325 indications near ten volts before a probability of 1×10^{-3} is reached. Given the probability of tensile rupture associated with a fifteen volt signal being 4×10^{-6}, it would take approximately 250 indications near fifteen volts before a probability of 1×10^{-3} is reached.

Therefore, ComEd will not calculate the contribution due to the probability of axial tensile burst unless greater than 250 indications in the range of ten to fifteen volts are detected or unless an indication greater than fifteen volts is detected.

10. The licensee proposed to add definitions of both the Locked TSP Model and the Freespan Mode into the Byron 1 and Braidwood 1 TSs. However, the staff review of the definitions proposed to be added to the TS Section 4.4.5.4.a indicate that intersections containing a corrosion-induced dent greater than 0.065 inches are not excluded. Provide a basis for this approach.

Response

Intersections containing a corrosion-induced dent greater than 0.065 inches are excluded from application of IPC based on the proposed Technical Specification. Proposed Technical Specification Sections 4.4.5.4.a.11 and 4.4.5.4.a.12 list areas excluded from application of both the Locked Tube Model and the Free Span Model IPC. These Technical Specification sections exclude IPC from being applied to "All tube-to-tube support plate intersections where IPC cannot be applied per Generic Letter 95-05." The Generic Letter requires the use of a 0.610 inch diameter bobbin coil probe for the inspection of 3/4 inch tubing. If a dent greater than 0.065 inches is present, passage of a 0.610 inch diameter bobbin coil probe is not possible; therefore, application of IPC at that intersection is not allowed per the Generic Letter and proposed Technical Specification definitions.

11. Provide the scheduled date for the start of the Braidwood 1 Cycle 6 refueling outage and the Byron 1 Cycle 8 refueling outage.

Response

The Braidwood 1 Cycle 6 refueling outage (A1R06) is scheduled to start March 29, 1997. The Byron 1 Cycle 8 refueling and steam generator replacement outage (B1R08) is scheduled to start November 7, 1997.

12. During the SG blowdown following a postulated main steamline break (MSLB), the pressure drop across a TSP will be determined by the position dependent flow distribution across a TSP. Because of the differences in resistances between fluid flows parallel and perpendicular to the SG tube bundles above the topmost TSP, a multidimensional flow pattern exists. This effect will be most pronounced at the upper TSP. Accordingly, assess the effect of the multidimensional flow pattern on the position dependent pressure drop across the TSPs.

Response

Analyses are underway to responds to this question at a later date.

References

1. ComEd letter dated March 5, 1996, "Braidwood Station Unit 1 Steam Generator Interim Plugging Criteria 90 Day Report"

2. ComEd letter dated September 9, 1996, "Byron Station Unit 1 Steam Generator Interim Plugging Criteria 90 Day Report for the End-of-Cycle 7 Inspection"