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Withhold from Public Disclosure in accordance with 10 CFR 2.390. Upon removal of Enclosure A, this Letter is uncontrolled.

10 CFR 50
10 CFR 51
10 CFR 54

RS-14-327

November 25, 2014

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: Response to NRC Request for Additional Information, Set 43, dated October 28, 2014, related to the Byron Station, Units 1 and 2, and Braidwood 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 Lindsay R. Robinson, US NRC to Michael P. Gallagher, Exelon, dated October 28, 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 43 (TAC NOS. MF1879, MF1880, MF1881, and MF1882)"

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 requested additional information to support NRC staff review of the LRA. This letter provides the response to the Reference 2 Request for Additional Information as follows:

1. Within Enclosure A – Response to Request for Additional Information containing Proprietary Information, based on Westinghouse letter LTR-PAFM-14-111, Attachment 1, "Byron and Braidwood Units 1 and 2 License Renewal: NRC Request for Additional Information Response (Proprietary)"

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2. Within Enclosure B - Response to Request for Additional Information with Proprietary Information redacted, based on Westinghouse letter LTR-PAFM-14-111, Attachment 2, "Byron and Braidwood Units 1 and 2 License Renewal: NRC Request for Additional Information Response (Non-Proprietary)"

As Item 1 contains information proprietary to Westinghouse Electric Company LLC, it is supported by an Affidavit signed by Westinghouse, the owner of the information. The Affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of Section 2.390 of the Commission's regulations.

Enclosure C of this letter provides the Westinghouse Application for Withholding Proprietary Information from Public Disclosure CAW-14-4064, accompanying Affidavit, Proprietary Information Notice, and Copyright Notice.

Accordingly, it is respectfully requested that the information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.390 of the Commission's regulations.

Correspondence with respect to the copyright or proprietary aspects of the item listed above or the supporting Westinghouse Affidavit should reference CAW-14-4064 and should be addressed to James A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company, 1000 Westinghouse Drive, Building 3 Suite 310, Cranberry Township, Pennsylvania 16066.

There are no 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 11-25-2014

Respectfully,

Michael P. Gallagher

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

Enclosures: A: Response to Request for Additional Information (Proprietary)
B: Response to Request for Additional Information (Non-Proprietary)
C: Application for Withholding Proprietary Information from Public Disclosure

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
Illínois Emergency Management Agency - Division of Nuclear Safety

Enclosure B

Byron and Braidwood Stations (BBS), Units 1 and 2
License Renewal Application
Response to Request for Additional Information

Non-Proprietary Response

RAI 4.3.4-3b

Notes:

1. The response contained in this Enclosure does not contain proprietary information. Such information has been redacted from the response as evidenced by the blank space within the brackets shown within the response.

2. As further explained in the Proprietary Information Notice and Affidavit contained in Enclosure C, the justification for considering certain information proprietary is indicated by means of lower case letters located as a superscript adjacent to the brackets identifying each proprietary item. These lower case letters correspond to Sections (4)(ii)(a) through (4)(ii)(f) of the Affidavit.

RAI 4.3.4-3b

Applicability:

Byron Station and Braidwood Station (BBS), all units

Background:

In its response to request for additional information (RAI) 4.3.4-3a, by letter dated September 11, 2014, the applicant provided its principles and bases for choosing a location made from one material to serve as the leading location for components within the same transient section that are made from different materials. In its response, the applicant stated that there are four transient sections at BBS that included components of different materials. To justify screening out components and selecting the leading location(s) to bound the other components, the applicant stated it applied bases dependent on the screening CUF_{en} values, the conservatism of the analysis method, and the range of the F_{en} potential reduction of each component and material.

Issue:

In its evaluation of the Pressurizer Transient Section, the applicant provided its justification to: (a) select the Surge Nozzle Structural Weld Overlay (SWOL) as the leading location and (b) remove the Lower Head at Heater Penetration and Upper Shell locations from consideration. The applicant stated that these eliminated components were analyzed using a more conservative methodology, therefore, more reduction in the CUF_{en} values are expected than for the Surge Nozzle SWOL. In its evaluation for the Unit 1 Replacement Steam Generator (RSG) Transient Section, the applicant also applied this same justification to eliminate the Inlet & Outlet Nozzle, Weld location. The staff is unclear how this justification would ensure that refinement of the CUF_{en} value of one material could bound the locations of different materials. The applicant did not provide sufficient justification that removing conservatism for one material would result in a proportional refinement for another material. The applicant did not demonstrate that these components would not need to be monitored by the Fatigue Monitoring program for environmentally assisted fatigue.

Also in its evaluation of the Unit 1 RSG transient section, the applicant removed the Primary Head Drain Hole from consideration. The leading location for this transient section, the Primary Head/Tubesheet Juncture, has a screening CUF_{en} value of 2.16. The screening CUF_{en} value for the Primary Head Drain Hole has a higher screening CUF_{en} value of 2.234 but was analyzed with a more conservative methodology. As part of its stress analysis ranking methodology, the applicant stated that it would only eliminate components from consideration if: (a) its screening CUF_{en} value is lower or the same and (b) its analysis method was more conservative. However, the applicant justified removing the Primary Head Drain Hole by stating that the screening CUF_{en} value for the leading location was only slightly less than the eliminated location. The applicant stated that this is not a concern because the Primary Head Drain Hole has a different analysis rank, therefore the potential reduction in the CUF_{en} value is greater. The staff is unclear why the analysis rank difference justifies removing this component from consideration. The staff is unclear if there are other instances where the applicant removed components from consideration that had a higher screening CUF_{en} than the selected leading location.

Request:

1. For the following components, provide justification that the refinement of the leading component material analysis would result in the leading component material location bounding these component materials in the transient section:

   a. Lower Head at Heater Penetration (Pressurizer Transient Section)
   b. Upper Shell (Pressurizer Transient Section)
   c. Inlet & Outlet Nozzle, Weld (Unit 1 RSG Transient Section)

2. For the Primary Head Drain Hole (Unit 1 RSG Transient Section), provide justification why the component was removed from consideration when the screening CUF_{en} was higher than the screening CUF_{en} value for the retained leading location.

3. Identify any additional instances where the screening CUF_{en} value for a component that was removed from consideration was higher than the screening CUF_{en} value of the retained leading location within the transient section. Justify removing these locations from consideration.

Response:

Note: The responses to requests in this request for information (RAI) repeatedly use the information from the response to RAI 4.3.4-3a, which was submitted in Exelon Letter RS-14-267, dated September 11, 2014. In addition, information associated with the response to RAI 4.3.4-5 is contained in Exelon Letter RS-14-266, dated September 11, 2014. Please refer to those letters for additional information.

1. Justification that the refinement of the leading component material analysis would result in the leading component material location bounding these component materials in the transient section is provided per Request 1:

   a. In the Pressurizer Transient Section, the Lower Head at Heater Penetration location was eliminated compared to the SWOL leading location using Basis Number 3. Basis Number 3 and the principles which support the bases were presented in the response to RAI 4.3.4-3a, Request 1, pages 3, 4, and 5 of Enclosure A. Basis number 3 is repeated below for convenience:

      Basis Number 3
      A location can be eliminated if, when compared to another location with a different material:

      - its screening CUF_{en} is the same or less, and
      - its analysis method (rank) is more conservative, and
      - its range of F_{en} potential reduction is less, provided the range of potential F_{en} reduction is further evaluated and still results in a lower CUF_{en}.

Explanation of the determination of analysis method (rank) and the associated conservatisms is presented in response to RAI 4.3.4-3a, Request 3, page 7 of Enclosure A.

An explanation of how each of the conditions above is met to justify removal of the Lower Head at Heater Penetration location from consideration as a leading location compared to the SWOL location follows:

- Its screening CUF_{en} is the same or less:
  The screening CUF_{en} of the Lower Head at Heater Penetration location is 2.108 and is less than the CUF_{en} of 14.329 for the SWOL location. Therefore, the first condition is satisfied.

- Its analysis method (rank) is more conservative:
  The Lower Head at Heater Penetration location was assigned a more conservative equipment stress analysis method rank of [ ]^{a,c,e} because its analysis used conservative scaling factors to account for geometric characteristics that were not explicitly included in the finite element model. By comparison, since this was not done for the SWOL location, it was assigned a less conservative equipment stress analysis method rank of [ ]^{a,c,e}. Therefore, refined stress analysis of the Lower Head at Heater Penetration location would produce greater stress reductions and correspondingly greater fatigue usage reductions than would refined analysis of the SWOL location. This follows from application of principles a, b, c(1), and d(1) provided in the response to RAI 4.3.4-3a, Request 1, page 3 of Enclosure A. Therefore, the second condition is also satisfied.

- Its range of F_{en} potential reduction is less, provided the range of potential F_{en} reduction is further evaluated and still results in a lower CUF_{en}:
  The third condition is addressed by applying principle "e" provided in the response to RAI 4.3.4-3a, Request 1, page 4, of Enclosure A. The Lower Head at Heater Penetration location is Low Alloy Steel (LAS), and its F_{en} value could not be reduced any further in a refined analysis, since the screening F_{en} value is already the minimum value possible for this material. The F_{en} for the Stainless Steel (SS) SWOL location could be reduced below the screening value, but its CUF_{en} is substantially higher. So further evaluation of the range of potential reduction in F_{en} for each location was necessary, to assure that the truly leading location is determined when there are different materials at the location being evaluated, in accordance with the third condition of Basis Number 3. As presented in the response to RAI 4.3.4-3a, Request 3, page 9 of Enclosure A, even if the SWOL location F_{en} were reduced to its minimum value, resulting in a CUF_{en} of 2.378, the Lower Head at Heater Penetration location's CUF_{en} of 2.108 would continue to be lower. Therefore, the third condition is satisfied.

Application of Basis Number 3 has demonstrated that:

- The screening CUF_{en} of the Lower Head at Heater Penetration is less than that of the SWOL location (2.108 vs. 14.329), and

- The effect of refining the more conservative stress analysis of the Lower Head at Heater Penetration to be of the same rigor (rank) as that of the SWOL would result in the CUF_{en} of the Lower Head at Heater Penetration being even lower than the CUF_{en} of the SWOL location (< 2.108 vs. 14.329), and

- The effect of potential F_{en} reduction for each material would result in the CUF_{en} of the Lower Head at Heater Penetration being lower than the CUF_{en} of the SWOL location (< 2.108 vs. 2.378)

Therefore, the SWOL location will continue to be a leading location after any further refinement in analysis, even though the locations have different materials.

As a result, refinements in the stress analysis done for the SWOL leading location to reduce the CUF_{en} to no greater than 1.0 for the period of extended operation remain bounding compared to the Lower Head at Heater Penetration location. Refinements of the Lower Head at Heater Penetration analysis to a stress analysis basis equivalent to that of the refined SWOL stress analysis are achievable (e.g., more explicit finite element modeling of component discontinuities) and would continue to produce lower CUF_{en} values compared to those at the SWOL leading location. Potential refinement in the environmental correction factor for each location has also been considered to assure that its refinement could not affect the determination of the leading location after considering the refinements in stress analysis. Considering that the SWOL location has been confirmed to be the leading location, monitoring based on the limits determined by refinement of the stress analysis for the SWOL location is bounding and appropriate for the Lower Head at Heater Penetration location to assure that the CUF_{en} is maintained no greater than 1.0 for both locations.

b. In the Pressurizer Transient Section, the Upper Shell location was eliminated compared to the SWOL leading location using Basis Number 3. Basis Number 3 and the principles which support the bases were provided in the response to RAI 4.3.4-3a, Request 1, pages 3, 4, and 5 of Enclosure A. Basis Number 3 is repeated below for convenience:

<u>Basis Number 3</u>
A location can be eliminated if, when compared to another location with a different material:
- its screening CUF_{en} is the same or less, and
- its analysis method (rank) is more conservative, and
- its range of F_{en} potential reduction is less, provided the range of potential F_{en} reduction is further evaluated and still results in a lower CUF_{en}.

An explanation of how each of the conditions above is met to justify removal of the Upper Shell location for consideration as a leading location compared to the SWOL location follows:

- Its screening CUF_{en} is the same or less:

The screening CUF_{en} of the Upper Shell location is 2.435 and is less than the CUF_{en} of 14.329 for the SWOL location. Therefore, the first condition is satisfied.

- Its analysis method (rank) is more conservative:
The Upper Shell location was assigned a more conservative equipment rank of [ ]^{a,c,e} because its stress analysis method used conservative scaling factors to account for geometric characteristics that were not explicitly included in the finite element model, conservative adjustments for transient conditions, and grouping of transients. By comparison, none of these were used in the SWOL location analysis, which therefore was a less conservative stress analysis method with an equipment stress analysis method rank of [ ]^{a,c,e}. Therefore, a refined stress analysis of the Upper Shell location would produce much greater stress reductions, and correspondingly much greater fatigue usage factor reductions, than would a refined analysis of the SWOL location. This conclusion is consistent with principles a, b, c(1) and d(1 and 3) provided in the response to RAI 4.3.4-3a, Request 1, pages 3 and 4 of Enclosure A. Therefore, the second condition is also satisfied.

- Its range of F_{en} potential reduction is less, provided the range of potential F_{en} reduction is further evaluated and still results in a lower CUF_{en}:
The third condition is addressed by applying principle "e" provided in the response to RAI 4.3.4-3a, Request 1, page 4 of Enclosure A. The Upper Shell location is LAS, and its F_{en} value could not be reduced any further in a refined analysis, since the screening F_{en} value is already the minimum value possible for this material. The F_{en} for the stainless steel SWOL location could be reduced below the screening value, but its CUF_{en} is substantially higher. So further evaluation of the range of potential reduction in F_{en} for each location was necessary, to assure that the truly leading location is determined when there are different materials at the locations being evaluated, in accordance with the third condition of Basis Number 3. As presented in the response to RAI 4.3.4-3a, Request 3, page 9 of Enclosure A, even if the SWOL F_{en} were reduced to its minimum value, the SWOL location CUF_{en} would be 2.378, which is essentially the same (within 2%) of the CUF_{en} of 2.435 for the Upper Shell location. The detailed stress basis comparison described above indicated a number of conservatisms in the analysis of the Upper Shell location that, if removed to provide a stress analysis method equivalent to that of the SWOL location, would overcome the insignificant 2% difference. This would result in the SWOL location having a higher CUF_{en}.

To address just one of these conservatisms, the effect of transient grouping was evaluated. To quantify the effects that transient grouping can have on a component's usage factor, a typical example from another Byron and Braidwood equipment component fatigue analysis was reviewed, where transient grouping had been reduced. In the example analysis, it was necessary to ungroup transients used in the component design fatigue analysis to remove conservatism, to qualify the component for power uprate transient impacts. From a group of three transients, one transient was removed and evaluated separately from the other two, which remained in the group. There is a transient group in the Upper Shell fatigue analysis that is similar to the transient group that was ungrouped in the example analysis. The effect of reducing the grouping by just one transient yielded an approximate 5% reduction in the cumulative usage factor. This example of the magnitude of conservatism in usage factor caused by transient grouping indicates that reduction of the conservatism of transient grouping, as well as the other conservatisms noted, from the Upper Shell location fatigue usage would reduce its CUF_{en} by more than 2% and to a value less than 2.3, which is lower than the CUF_{en} of 2.378 for the SWOL location. Therefore, the third condition is also satisfied.

Application of Basis Number 3 has demonstrated that:

- The screening CUF_{en} of the Upper Shell location is less than that of the SWOL location (2.435 vs. 14.329), and
- The effect of refining the more conservative stress analysis of the Upper Shell location to be of the same rigor (rank) as that of the SWOL would result in the CUF_{en} of the Upper Shell location being even lower than the CUF_{en} of the SWOL location (< 2.435 vs. 14.329), and
- The effect of potential F_{en} reduction with further evaluation for each material would result in the CUF_{en} of the Upper Shell location being lower than the CUF_{en} of the SWOL location (< 2.3 vs. 2.378).

Therefore, the SWOL location will continue to be a leading location after any further refinement in analysis, even though the locations have different materials.

As a result, any refinements in the stress analysis done for the SWOL leading location to reduce the CUF_{en} to no greater than 1.0 for the period of extended operation would remain bounding compared to the Upper Shell location. Refinements of the Upper Shell location analysis to a stress analysis basis equivalent to that of the refined SWOL leading location stress analysis are achievable (e.g., more explicit finite element modeling of component discontinuities, reduction of conservative transient adjustments, and reduction of transient grouping) and would continue to produce lower CUF_{en} values compared to those at the SWOL leading location. Potential refinement in the environmental correction factor for each location has also been considered to assure that its refinement could not affect the determination of the leading location after considering the refinements in stress analysis. Considering that the SWOL location has been confirmed to be the leading location, monitoring based on the limits determined by refinement of the stress analysis for the SWOL leading location is bounding and appropriate for the Upper Shell location to assure that the CUF_{en} is maintained no greater than 1.0 for both locations.

c. In the Unit 1 RSG Transient Section, the Inlet and Outlet Nozzle Weld location was eliminated compared to the Primary Head/Tubesheet Juncture leading location using Basis Number 2. Basis number 2 and the principles supporting the basis were presented in RAI 4.3.4-3a, response to Request 1, pages 3, 4, and 5 of Enclosure A. Basis Number 2 is repeated below for convenience:

Basis Number 2

A location can be eliminated if, when compared to another location with a different material:

- its screening CUF_{en} is the same or less, and
- its analysis method (rank) is more conservative, and
- its range of F_{en} potential reduction is greater.

An explanation of how each of the conditions above is met to justify removal of the Inlet and Outlet Nozzle Weld location for consideration as a leading location compared to the Primary Head/Tubesheet Juncture location follows:

- Its screening CUF_{en} is the same or less:
  The screening CUF_{en} for the Inlet and Outlet Nozzle Weld location is 1.842 and is less than the CUF_{en} of 2.16 for the Primary Head/Tubesheet Juncture location. Therefore, the first condition is satisfied.

- Its analysis method (rank) is more conservative:
  The Inlet and Outlet Nozzle Weld location has a more conservative equipment stress analysis method rank of [ ]^{a,c,e} vs. a less conservative equipment stress analysis method rank of [ ]^{a,c,e} for the Primary Head/Tubesheet Juncture location. This is primarily because the Inlet and Outlet Nozzle Weld location stress and fatigue analysis used only nine transient groups, compared to the more detailed sixteen transient groups used in the Primary Head/Tubesheet Juncture location analysis. Therefore, refined analysis of the Inlet and Outlet Nozzle Weld would result in more reduction of fatigue usage than a refined analysis of the Primary Head Tubesheet Juncture. This follows from application of principles a, b, c(1), and d(3) provided in the response to RAI 4.3.4-3a, Request 1, pages 3 and 4 of Enclosure A. Therefore, the second condition is satisfied.

- Its range of F_{en} potential reduction is greater:
  The third condition is addressed by applying principle "e" provided in the response to RAI 4.3.4-3a, Request 1, page 4 of Enclosure A. The screening F_{en} for the Primary Head/Tubesheet Juncture location was 2.455, which is the minimum potential value for LAS, and can be reduced no further. The screening evaluation conservatively applied the stainless steel F_{en} of 15.438 to the Nickel Alloy Inlet and Outlet Nozzle Weld location due to its proximity to the stainless steel safe end. The potential reduction in stainless steel F_{en} for the Inlet and Outlet Nozzle Weld location is from 15.438 to 2.547, which is a factor of 6. If the less conservative Nickel alloy F_{en} were applied to the Inlet and Outlet Nozzle Weld location, the potential reduction in F_{en} from 4.524 to 1.0 would result in a reduction factor of 4.5. Since the Primary Head/Tubesheet Juncture location has no potential reduction in F_{en}, and the Inlet and Outlet Nozzle Weld location has greater potential reduction of at least 4.5, the third and final condition of Basis 2 is satisfied. Therefore, applying any F_{en} reduction, from a very small amount to the minimum potential F_{en} reduction factor of 4.5, would maintain the CUF_{en} of the Inlet and Outlet

Nozzle Weld location less than the CUF_{en} of the Primary Head/Tubesheet Juncture location.

Application of Basis Number 2 has demonstrated that:

- The screening CUF_{en} of the Inlet and Outlet Nozzle Weld location is less than that of the Primary Head/Tubesheet Juncture location (1.842 vs. 2.16), and

- The effect of refining the more conservative stress analysis of the Inlet and Outlet Nozzle Weld location to be of the same rigor (rank) as that of the Primary Head/Tubesheet Juncture location would result in the CUF_{en} of the Inlet and Outlet Nozzle Weld location being even lower than the CUF_{en} of the Primary Head/Tubesheet Juncture location (<1.842 vs. 2.16), and

- The range of F_{en} potential reduction is greater for the Inlet and Outlet Nozzle Weld location, so that the effect of potential F_{en} reduction for each material would result in the CUF_{en} of the Inlet and Outlet Nozzle Weld location remaining lower than the CUF_{en} of the Primary Head/Tubesheet Juncture location (<1.842 vs. 2.16).

Therefore, the Primary Head/Tubesheet Juncture location will continue to be a leading location after any further refinement in analysis, even though the locations have different materials.

As a result, any refinements in the stress analysis done for the Primary Head/Tubesheet Juncture leading location to reduce the CUF_{en} to no greater than 1.0 for the period of extended operation would remain bounding compared to the Inlet and Outlet Nozzle Weld location. Refinements of the Inlet and Outlet Nozzle Weld analysis to a stress analysis basis equivalent to that of the refined Primary Head/Tubesheet Juncture stress analysis are achievable (e.g., reduction of transient grouping) and would continue to produce lower CUF_{en} values compared to those at the Primary Head/Tubesheet Juncture leading location. Potential refinement in the environmental correction factor for each location has also been considered to assure that its refinement could not affect the determination of the leading location after considering the refinements in stress analysis. Considering that the Primary Head/Tubesheet Juncture location has been confirmed to be the leading location, monitoring based on the limits determined by refinement of the stress analysis for the Primary Head/Tubesheet Juncture leading location is bounding and appropriate for the Inlet and Outlet Nozzle Weld location to assure that the CUF_{en} is maintained no greater than 1.0 for both locations.

2. For the Primary Head Drain Hole location (Unit 1 RSG Transient Section), the justification why the component was removed from consideration when the screening CUF_{en} was higher than the screening CUF_{en} value for the retained leading location is as follows:

   The elimination of the Primary Head Drain Hole location in the Unit 1 RSG transient Section does not involve comparison of locations with different material types. The

Primary Head Drain Hole location that is being eliminated and the Primary Head Tubesheet Juncture leading location to which it is being compared are both LAS.

Comparison of these LAS locations showed that the Primary Head Drain Hole had a slightly higher CUF_{en} of 2.234 than the Primary Head/Tubesheet Juncture CUF_{en} of 2.160. Since these are essentially the same (less than 4% different) value of about 2.2, additional stress basis comparison was necessary to determine the leading location for this equipment. This additional stress basis comparison is discussed in Response to RAI 4.3.4-5 on page 31 of Enclosure B of Letter RS-14-266 and is described as follows:

"Additional stress basis comparison was performed in Step 5 when identifying leading locations for a single system or piece of equipment."

Prior to this action in Step 5, component locations were eliminated from consideration as leading locations only when the screening CUF_{en} was lower or the same and its analysis method ranking was more conservative. This additional stress basis comparison occurred when differences in conservatism of the stress analysis methods between the locations being compared could affect the selection of the leading location, when the screening CUF_{en} of a potentially leading location was greater than another location. This was done to identify the truly leading location and assure that refined analysis would identify bounding and appropriate limits. This also applies to those locations discussed in response to Request 3 below. The summary of the additional stress analysis basis comparison and basis for selection of the leading location follows.

The analysis of record (AOR) evaluations described the conservatisms in each analysis, which were used to determine the stress analysis method rankings of [ ]^{a,c,e} (more conservative) for the Primary Head Drain Hole and [ ]^{a,c,e} (less conservative) for the Primary Head/Tubesheet Juncture. For example, the Primary Chamber Drain fatigue analysis used prorating factors in its evaluation, whereas the Primary Head/Tubesheet Juncture directly evaluated the loading conditions using a Finite Element (FE) model, and no prorating factors were applied. Also, the maximum Stress Intensity (SI) range reported for the Primary Head/Tubesheet Juncture is approximately double that of the Primary Head Drain Hole, and it also exceeded the 3Sm limit, requiring Simplified Elastic-Plastic evaluation and K_e penalty to the usage factor. This indicates less opportunity for reduction of conservatism for the Primary Head/Tubesheet Juncture analysis.

One notable conservatism exclusive to the Primary Head Chamber Drain fatigue analysis was the use of a conservative inlet/outlet temperature difference in the stress calculation for controlling transients. This resulted in a minimum conservatism of 5% on the stresses used for these transients. Investigation of the impact of this conservatism determined that its removal would allow reduction of the usage factor contribution by 17% or greater, based on the alternating stresses for the controlling transients. Note that these transients were not controlling for the Primary Head/Tubesheet location. Therefore, the effect of this conservatism is unique to the Primary Drain Hole analysis.

Therefore, considering the unique potential for decrease in fatigue usage in the range of 17% or more for the Primary Head Drain Hole, its CUF_{en} could be reduced much more than the 4% difference in the screening CUF_{en} values, and it can be eliminated with respect to the Primary Head/Tubesheet Juncture leading location.

As a result, any refinements in the stress analysis done for the Primary Head/Tubesheet Juncture location to reduce the CUF_{en} to no greater than 1.0 for the period of extended operation remain bounding compared to the Primary Drain Hole location. Refinements of the Primary Drain Hole location analysis to a stress analysis basis equivalent to that of the refined Primary Head/Tubesheet Juncture location stress analysis are achievable (e.g., reduction of enveloping transient stresses and resulting fatigue usage contribution for controlling transients) and would continue to produce lower CUF_{en} values compared to those at the Primary Head/Tubesheet Juncture location. Considering that the Primary Head/Tubesheet Juncture location has been confirmed to be the leading location, monitoring based on the limits determined by refinement of the stress analysis for the Primary Head/Tubesheet Juncture location is bounding and appropriate for the Primary Drain Hole location to assure that the CUF_{en} is maintained no greater than 1.0 for both locations.

3. The responses to Requests 1 and 2 addressed the questions concerning the equipment. Comparisons of locations of different materials occur only in the equipment for Byron and Braidwood, and therefore justifications for removal of equipment locations where the stress basis comparison dominated the CUF_{en} comparison were already addressed in those responses. The remaining scope of the screening evaluation was the piping locations, where all materials are stainless steel.

   Note that for the piping systems, the stress analysis method ranking was described in the response to RAI 4.3.4-5, Request 2. The response provided the steps of the EAF screening process. Step 4, Stress Basis Comparison, provides the hierarchical list, where rank 1 is the most conservative and rank 5 is the least conservative. Discussion of Step 4 is provided on pages 30 and 31 of Enclosure B, in Exelon Letter RS-14-266, dated September 11, 2014.

   In the stainless steel piping systems, there were two instances where the screening CUF_{en} value for a component that was removed from consideration was higher than the screening CUF_{en} value of the retained leading location within the transient section, based on detailed stress basis comparisons. In the Reactor Coolant Loop (RCL) piping subsystem, the Main Loop Stop Valve with a screening CUF_{en} of 10.04 and a piping stress analysis method rank of [ ]^{a,c,e} was retained, and the Hot Leg Piping location with a screening CUF_{en} of 13.41 and a more conservative piping stress analysis method rank of [ ]^{a,c,e} was eliminated. In the Pressurizer Safety and Relief Valve (PSARV) piping subsystem, the 3/4 inch branch (safety line) with a screening CUF_{en} of 14.64 and a piping stress analysis method rank of [ ]^{a,c,e} was retained, and the 3 inch valve butt weld with a screening CUF_{en} of 15.10 and a more conservative piping stress analysis method rank of [ ]^{a,c,e} was eliminated. The justifications for each of these are described below.

   The response to RAI 4.3.4-3a described principles that are considered when using stress basis comparisons and consideration of the environmental fatigue correction factor (F_{en}) for selection of leading locations that involved comparisons of locations having different materials. The principles support the bases for stress basis comparison discussed in the response to RAI 4.3.4-3a. The basic principles that support the bases to assess influences of stress analysis methods on fatigue usage (principles a through d) are also applicable to locations with the same material. In particular, influences of the stress analysis methods reflected in the ranking system used are related to principles d(1, 2, and 3) outlined in the response to RAI 4.3.4-3a.

In determining the final leading locations for the piping systems, the additional action stated on page 31 of Enclosure B of RS-14-266, "Additional stress basis comparison was performed in Step 5 when identifying leading locations for a single system or piece of equipment," was performed. Up to and including Step 5, the screening methodology eliminated only those locations that had a screening CUF_{en} lower and a stress analysis basis that was more conservative than the compared location. When determining leading locations at the subsystem and equipment level, as stated, additional stress basis comparison was necessary to assure that the truly leading location was selected. The additional stress basis comparison and the justification for the selection of the leading locations are presented below for the two piping locations previously identified.

In the additional stress basis comparisons, a location with a higher CUF_{en} can be eliminated if, when compared to another location, its analysis method (rank) is more conservative than the other location, and reduction of the conservatism in its analysis method (rank) to the same as that of the other location would be sufficient to reduce its screening CUF_{en} below that of the other location. This was demonstrated for the RCL piping subsystem and the PSARV piping subsystem locations as described below.

RCL Piping Subsystem Locations

The Hot Leg Piping location with a screening CUF_{en} of 13.41 was the weld to the Reactor Vessel Outlet Nozzle (RVON), which represents a gross structural discontinuity. It was assigned the most conservative piping stress analysis method rank of [ ]^{a,c,e}, since it was evaluated using NB-3600 one dimensional (1D) heat transfer and stress analysis methods. It was compared to the selected leading location, which was a Main Loop Stop Valve, with a screening CUF_{en} of 10.04. It was assigned the least conservative piping stress analysis method rank of [ ]^{a,c,e}, since it was evaluated using detailed NB-3200 stress analysis methods. Both locations are stainless steel, therefore the screening F_{en} values are the same. Even though the Hot Leg Piping location has a higher screening CUF_{en}, the large difference in analysis conservatism is also considered for comparison to the Main Loop Stop Valve.

The Hot Leg Piping location with a stress analysis method rank [ ]^{a,c,e} includes conservatism due to:

- 1D heat transfer analysis, which results in higher calculated thermal stresses at discontinuities compared to 2D or 3D finite element analysis heat transfer
- Simplified formulas for stress intensity range, which include enveloping secondary stress indices from ASME NB-3680 to produce conservative stresses
- Absolute combination of stress intensity ranges due to each loading range (pressure, moment, thermal) in NB-3600 equations, versus the less conservative NB-3200 method of algebraically combining stress components from all loadings before determining the total stress intensity range.

The Main Loop Stop Valve analysis with a stress analysis method rank of [ ]^{a,c,e} does not include any of these conservatisms.

In addition to these general differences in conservatism in stress analysis methods, the Hot Leg Piping location was also conservatively analyzed using an older version of the NB-3600 equations that included the radial thermal gradient stress in the Primary Plus Secondary Stress Intensity Range (Equation 10). For the structural discontinuity location, this results in conservative K_e penalty factors on the alternating stress, which increases the usage factor non-linearly. Therefore, the Hot Leg Piping location stress analysis contained additional conservatism beyond the differences attributed to the stress analysis method ranking.

Based on comparisons of typical RCL fatigue analyses of the same Hot Leg Piping location at other Westinghouse plants with similar loads and transients, the usage factor for a similar plant evaluated to the later version of the Code with Equation 10 revised was 0.4, compared to the Byron/Braidwood usage factor of 0.87. Therefore, the valid exclusion of the radial thermal gradient stress term from Equation 10 in a 1D NB-3600 analysis reduces the CUF approximately by a factor of 2. The additional conservatisms listed above based on the stress analysis method difference would substantially increase this factor.

Accounting for only one of these factors of conservatism, the common stress basis comparison between the Hot Leg Piping location and the Main Loop Stop Valve should result in a CUF_{en} much less than 6.7 (13.4/2) for the Hot Leg Piping location. Since 6.7 is less than 10.04 and significantly more conservatism exists in the stress analysis methods for the Hot Leg Piping location, it is concluded that the Main Loop Stop Valve is the leading location in the RCL piping.

Therefore, any refinements in the stress analysis done for the Main Loop Stop Valve location to reduce the CUF_{en} to no greater than 1.0 for the period of extended operation remain bounding compared to the Hot Leg Piping location. Refinements of the Hot Leg Piping location analysis to a stress analysis basis equivalent to that of the refined Main Loop Stop Valve stress analysis are achievable (e.g., detailed finite element analysis and NB-3200 stress evaluation methods) and would continue to produce lower CUF_{en} values compared to those at the Main Loop Stop Valve location. Considering that the Main Loop Stop Valve location has been confirmed to be the leading location, monitoring based on the limits determined by refinement of the stress analysis for the Main Loop Stop Valve location is bounding and appropriate for the Hot Leg Piping location to assure that the CUF_{en} is maintained no greater than 1.0 for both locations.

PSARV Piping Subsystem Locations

The PSARV 3 inch valve butt weld with a screening CUF_{en} of 15.10 and a piping stress analysis method rank of [ ]^{a,c,e} was eliminated when compared to the 3/4 inch branch (safety line) with a screening CUF_{en} of 14.64 and a piping stress analysis method rank of [ ]^{a,c,e}, which was retained as the leading location. Since the screening CUF_{en} of the valve butt weld was only 3% higher than that of the branch, the stress analysis method rank difference was investigated to determine the truly leading location.

The fatigue analysis of the 3/4 inch branch (safety line) was given a stress analysis method rank of [ ]^{a,c,e} because finite element analysis was used to reduce the stress intensity range terms in the NB-3600 equations for both pressure stress and thermal stress. Also, approximately 20% of the calculated usage factor was due to valve thrust mechanical load stress cycles that occur commensurate with the thermal transients in the line. This portion of the usage is not easily reduced by refined analysis. In addition, the 3/4 inch branch (safety line) is on an elbow in the Safety line, which required adjustment of the piping component stress indices, and the related interaction of the branch and elbow geometries also makes refined analysis modeling and resulting stress refinement less susceptible to further reduction.

The fatigue analysis of the 3 inch valve butt weld was given a stress analysis method rank of [ ][a,c,e] because finite element analysis was used to reduce the stress intensity range terms in the NB-3600 equations for only thermal stress. Also, the contribution to the calculated usage factor from valve thrust mechanical load stress cycles at this location was negligible.

Since the 3 inch valve employed less finite element analysis and no piping component stress interaction adjustment, compared to the 3/4 inch branch (safety line), a refined analysis of the 3 inch valve butt weld would reduce the fatigue usage from the current value by more than a 3% difference from the reduction that could be obtained from a refined analysis of the 3/4 inch branch (safety line). An investigation was made of the 3 inch valve butt weld fatigue analysis to quantify the effect of using finite element stress to reduce the stress intensity range term for pressure, thus making its stress analysis method more equivalent to that of the 3/4 inch branch. As a result, the investigation showed that the CUF_{en} of the 3 inch valve could be reduced by approximately 50%. This more than compensates for the 3% difference in the screening CUF_{en} values when the ranking was different, and confirms the selection of the 3/4 inch branch as the leading location.

Therefore, any refinements in the stress analysis done for the 3/4 inch branch (safety line) location to reduce the CUF_{en} to no greater than 1.0 for the period of extended operation remain bounding compared to the 3 inch valve butt weld location. Refinements of the 3 inch valve butt weld analysis to a stress analysis basis equivalent to that of the refined 3/4 inch branch (safety line) stress analysis are achievable (e.g., more explicit finite element modeling of component stresses due to pressure loadings) and would continue to produce lower CUF_{en} values compared to those at the 3/4 inch branch (safety line) location. Considering that the 3/4 inch branch (safety line) location has been confirmed to be the leading location, monitoring based on the limits determined by refinement of the stress analysis for the 3/4 inch branch (safety line) location is bounding and appropriate for the 3 inch valve butt weld location to assure that the CUF_{en} is maintained no greater than 1.0 for both locations.

Enclosure C

Application for Withholding Proprietary Information from Public Disclosure

Supporting the following Set 43 RAI Response

RAI 4.3.4-3b

Notes:

1. The Proprietary version of the response is contained in Enclosure A.

2. This Enclosure consists of this cover page and seven pages associated with the Westinghouse Application for Withholding Proprietary Information from Public Disclosure.

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CAW-14-4064

November 24, 2014

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: LTR-PAFM-14-111, Attachment 1, "Byron and Braidwood Units 1 and 2 License Renewal: NRC Request for Additional Information Response" (Proprietary)

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-14-4064 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The Affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.390 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying Affidavit by Exelon Generation Company, LLC.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse Affidavit should reference CAW-14-4064, and should be addressed to James A. Gresham, Manager, Regulatory Compliance, Westinghouse Electric Company, 1000 Westinghouse Drive, Building 3 Suite 310, Cranberry Township, Pennsylvania 16066.

Very truly yours,

J A Gresham

James A. Gresham, Manager
Regulatory Compliance

Enclosures

CAW-14-4064
November 24, 2014

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF BUTLER:

I, James A. Gresham, am authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of my knowledge, information, and belief.

J. A. Gresham

James A. Gresham, Manager
Regulatory Compliance

(1) I am Manager, Regulatory Compliance, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse Application for Withholding Proprietary Information from Public Disclosure accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitute Westinghouse policy and provide the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of

Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

(iii) There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iv) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.

(v) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(vi) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in LTR-PAFM-14-111, Attachment 1 "Byron and Braidwood Units 1 and 2 License Renewal: NRC Request for Additional Information Response" (Proprietary), for submittal to the Commission, being transmitted by Exelon Generation Company, LLC letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse is that associated with NRC letter 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 43 (TAC NOS. MF1879, MF1880, MF1881, AND MF1882), and may be used only for that purpose.

(a) This information is part of that which will enable Westinghouse to:

(i) Perform environmental fatigue screening with consideration for different materials within the same transient section.

(ii) Utilize the Westinghouse Reference Fatigue Database

(b) Further this information has substantial commercial value as follows:

(i) Westinghouse plans to sell the use of the information to its customers for the purpose of performing environmental fatigue screening evaluations with consideration of different materials within the same transient section.

(ii) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar environmental fatigue screening and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

PROPRIETARY INFORMATION NOTICE

Transmitted herewith are proprietary and non-proprietary versions of documents furnished to the NRC in connection with NRC letter 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 43 (TAC NOS. MF1879, MF1880, MF1881, AND MF1882), and may be used only for that purpose.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the Affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

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