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U. S. Nuclear Regulatory Commission
ATTN: 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 Request for Additional Information Regarding Generic Letter 2004-02, "Potential Impact of Debris Blockage On Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors"

References:

1. Letter from M. J. David (U. S. NRC) to C. G. Pardee (Exelon Generation Company, LLC), "Braidwood Station, Units 1 and 2, and Byron Station, Units 1 and 2 – Request for Additional Information Related to Generic Letter 2004-02 (TAC Nos. MC4667, MC4668, MC4669, and MC4670)," dated July 24, 2008

2. Letter from P. R. Simpson (Exelon Generation Company, LLC) to U. S. NRC, "Response to Request for Additional Information Related to NRC Generic Letter 2004-02, 'Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors,'" dated September 19, 2008

3. Letter from M. J. David (U. S. NRC) to C. G. Pardee (Exelon Generation Company, LLC), "Braidwood Station, Units 1 and 2, and Byron Station, Unit Nos. 1 and 2 – Request for Additional Information Related to Generic Letter 2004-02 (TAC Nos. MC4667, MC4668, MC4669, and MC4670)," dated April 15, 2009

In Reference 1, the Nuclear Regulatory Commission (NRC) requested additional information from Exelon Generation Company, LLC (EGC) to verify the structural adequacy of equipment that had been installed to address Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage On Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors." EGC provided the requested information in Reference 2.

In Reference 3, the NRC requested additional information regarding the EGC response provided in Reference 2. The NRC clarified the question during a teleconference between EGC and the NRC on April 14, 2009. The Attachment to this letter provides the requested information.

There are no regulatory commitments contained in this letter. If you have any questions concerning this letter, please contact Ms. Lisa A. Schofield at (630) 657-2815.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 29th day of May 2009.

Respectfully,

Patrick R. Simpson
Manager – Licensing
Exelon Generation Company, LLC

Attachment: Response to Request for Additional Information Regarding Generic Letter 2004-02

Question

The Nuclear Regulatory Commission (NRC) staff is reviewing Exelon Generation Company, LLC's (the licensee's) letter dated September 19, 2008 (Agencywide Documents Access and Management System Accession No. ML082660245), which responded to the NRC staff's Request for Additional Information dated July 24, 2008 (ADAMS Accession No. ML081930604), related to NRC Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," dated September 13, 2004. The NRC staff has determined that additional information is required to complete its review.

Specifically, in your September 19, 2008, response, you indicated that hydrodynamic loading need not be evaluated with respect to the structural adequacy of the strainers. Your justification was stated as "...the interaction between the strainer and the water inside the sump pit is not relevant due to the small volume of the sump..." Based on the high maximum stress ratios provided in your December 31, 2007, supplemental submittal (ADAMS Accession No. ML080280562) for certain components (notably, Strut Head No. 1 and Side Wall with Discontinuity Stress), even a small hydrodynamic loading value could have a large impact with respect to the structural qualification of the strainer components. Given these implications, please provide additional justification regarding the omission of the hydrodynamic loading term in the previous submittals. Justification could include, but is not limited to, additional analyses of vulnerable components (i.e., Strut Head No. 1 and Side Wall) and/or discussions of conservatisms, inherent or otherwise, not explicitly stated in the previous submittals.

Response

Although the hydrodynamic forces acting on the strainer assembly are low, any nominal loading would appear to result in stresses exceeding design limits based on the lack of margin indicated in the maximum stress ratios published in Table 3k2-1 of the EGC response dated December 31, 2007. The specific component elements include Strut Head 1 (for the Support Structure), with a ratio of 1.00, and Side Wall with Discontinuity Stress (for the Short Cartridge Assembly), with a ratio of 0.99. The actual margin available for each of these component elements is discussed below.

<u>Support Structure - Strut Head 1:</u>

The subject component is the strut end of the connection to the strainer assembly on one end and the containment sump structure at the other end. These struts provide horizontal restraint at the top of the strainer structure to resist primarily seismic loading.

This part was analyzed using finite-element modeling (FEM) techniques, which models the strut head using three-dimensional solid elements. The high stress regions determined using this methodology represent localized stresses.

The loads used in the analysis of the strut head were taken from the output of a separate finite-element analysis of the overall strainer structural model. The strainer structure was evaluated for seismic loads using peak horizontal and vertical accelerations with 2% and 3% of critical damping for Operating Basis Earthquake (OBE) and Safe Shutdown

Earthquake (SSE), respectively. These peak accelerations were multiplied by a factor of 1.5 to account for multiple modes of vibration.

A separate modal analysis was performed to confirm that vertical restraints for the strainer are not required. A review of this modal analysis determined that there are no significant closely spaced modes in the horizontal directions. Therefore, use of peak values multiplied by 1.5 provides conservative results for the forces acting on the strut head and thus sufficient margin is present for any nominal hydrodynamic loading on the strainer.

Short Cartridge Assembly - Side Wall with Discontinuity Stress:

The maximum differential pressure (head loss) employed for the structural analysis is 15.54 ft. The maximum calculated head loss is 8.27 ft, which occurs at 73.4°F. At higher temperatures, the head loss is as low as 4.13 ft. The difference between 15.54 and 8.27 feet of differential pressure represents a minimum margin in the structural analysis of greater than 7.0 ft. The differential pressure loading accounts for almost 98% of the load on the screens. Since the load on the screens is almost exclusively dependent upon the head loss, the documented margin in head loss is nearly identical to the margin in stress loading on the screens.

As an additional measure of margin, the head loss calculated at 73.4°F assumes both the containment spray (CS) and residual heat removal (RH) pumps are running at full demand, with a total flow rate of 10,000 gpm across the sump screens. Emergency Operating Procedures provide directions to shut off the CS pumps as soon as eight hours after the accident. The containment recirculation sump water temperature will not decrease to less than 100°F until well beyond eight hours after the initiating event. As a result, by the time the water flowing through the screens decreases to a temperature of 73.4°F, the CS pump will no longer be in operation. Thus, when the water temperature reaches 73.4°F, the sump flow rate will have decreased to the maximum flow associated with the RH pump, 5,000 gpm. This flow reduction will further reduce the differential pressure across the screens, further increasing the margin in the structural analysis.

Although the hydrodynamic forces acting on the strainer are low, there is adequate margin available to account for a nominal increase in loading based on the conservative methods used in analyzing the strainer components as described above.