REQUEST FOR ADDITIONAL INFORMATION

REGARDING PROPOSED LICENSE AMENDMENT

EXTENDED POWER UPRATE

EXELON GENERATION COMPANY, LLC

PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3

DOCKET NOS. 50-277 AND 50-278

Proprietary information pursuant to
Title 10 of the *Code of Federal Regulations* (10 CFR) Section 2.390
has been redacted from this document.
Redacted information is identified by blank space enclosed within double brackets
as shown here [[ ]].

Enclosure 2

REQUEST FOR ADDITIONAL INFORMATION

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EXTENDED POWER UPRATE

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By letter dated September 28, 2012, as supplemented by letters dated February 15, 2013, May 7, 2013, May 24, 2013, June 4, 2013, June 27, 2013, July 30, 2013, July 31, 2013, August 5, 2013, August 22, 2013, August 29, 2013, September 13, 2013, October 11, 2013, October 15, 2013, October 31, 2013, December 6, 2013, and December 20, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML122860201, ML13051A032, ML13129A143, ML13149A145, ML13156A368, ML13182A025, ML13211A457, ML13213A285, ML13217A431, ML13240A002, ML13241A418, ML13260A076, ML13289A191, ML13289A300, ML13308A331, ML13345A687, and ML13358A083, respectively), Exelon Generation Company, LLC (Exelon, the licensee) submitted a license amendment request for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3. The proposed amendment would authorize an increase in the maximum power level from 3514 megawatts thermal (MWt) to 3951 MWt. The requested change, referred to as an extended power uprate (EPU), represents an increase of approximately 12.4 percent above the current licensed thermal power level (CLTP).

The Nuclear Regulatory Commission (NRC) staff is reviewing your submittal and has determined that additional information is needed to complete its review. The specific request for additional information (RAI) is addressed below.

Mechanical and Civil Engineering Branch (EMCB)
Reviewer: Chakrapani Basavaraju
EMCB-SD-RAI-16

A Westinghouse octagonal shaped three ring vane bank replacement steam dryer (RSD) was recently installed at the Monticello Nuclear Generating Plant (Monticello) to support an EPU. Several boiling-water reactors (BWRs) in Europe have also installed this Westinghouse steam dryer. Exelon plans to install the same type RSD at the PBAPS to support the proposed EPU, and is using the Monticello data as a benchmark for their dryer analysis procedure. The NRC staff has noted that the azimuthal orientation of the PBAPS RSD (Figure 2-1 of Reference 1) is [[ ]] relative to the orientation of the Monticello RSD. [[

]] Please provide the following:

a) Explain why the PBAPS RSD is oriented [[
]]
compared to the Monticello RSD.

b) Provide any known operating experience data regarding the BWRs in Europe with Westinghouse steam dryers that are oriented similar to the PBAPS RSDs.

c) Since the PBAPS RSD and Monticello dryer orientations are different, the associated steam flow velocities, vorticities, and turbulence within the vessels and the dipole sources at the main steam line (MSL) entrances may be different. Therefore, the dipole sources developed based on the Monticello RSD benchmark data may not be applicable for the analysis of the PBAPS RSD design. Provide any fluid dynamic information related to the MSL inlet flow, vorticity, and resulting dipole sources for the PBAPS RSD orientation as compared to the benchmark Monticello orientation. Explain what steps will be taken to ensure that the dipole strengths used for the PBAPS RSD evaluations are conservative.

d) Please provide a quantitative analysis of the impact of the pressure loads on the outer hoods of the PBAPS RSD for the following two orientations: (1) Monticello RSD orientation; and (2) proposed PBAPS RSD orientation [[ ]].

EMCB-SD-RAI-17

In Reference 2, the pressure spectra recorded during the scale model tests (SMTs) show [[ ]] at the safety relief valve (SRV) resonance frequencies. Since the transient conditions [[ ]] used in the SMTs may affect the bump-up factor results, please provide the following:

a) Perform a sensitivity analysis, using the test samples [[
]] Provide the results of this analysis including any impacts on resonance amplitude and bump-up factors.

b) This RAI question has been deleted.

EMCB-SD-RAI-18

This RAI question has been deleted.

EMCB-SD-RAI-19

Reference 2 notes that one of the blind-flanged standpipes on the dead-ended leg of MSL C will be replaced with a Dresser SRV. Please provide the standpipe dimensions for the new Dresser SRV in comparison to the existing SRV standpipes.

EMCB-SD-RAI-20

This RAI question has been deleted.

EMCB-SD-RAI-21

In Section 5.3 of Reference 3, it appears that some peaks other than those caused by the [[
]] were filtered. Please provide information about any peaks, other than those due to [[ ]], which have been filtered from the signals of the MSL strain gages.

EMCB-SD-RAI-22

Figures 3-2 to 3-5 of Reference 1 show [[
]] Please provide the following:

a) The averaging of pressure spectra over large dryer areas (e.g., quadrants) does not provide an accurate description of the load distribution on the dryer. Explain whether these pressure spectra are averaged over the respective quadrants or they represent local spectra at selected points on the quadrants.

b) Explain the nature of the [[ ]] which appears in the estimated EPU load on the RSD for PBAPS Unit 3.

EMCB-SD-RAI 23

Explain how the acoustic pressure field in the [[
]], as presented in Reference 1, is mapped to the curved continuous structural surfaces of the PBAPS RSD structural finite element model mesh. Discuss any bias errors associated with this mapping and how are they accounted for in the dryer stress analyses.

EMCB-SD-RAI-24

The dryer skirt is partially submerged in boiling or saturated water, which imparts random fluctuating pressure pulsations to the bottom of the structure. These loads were not accounted for in the Acoustic Circuit Model (ACM), or in the Quad Cities Unit 2 based bias errors and uncertainties. Please provide details on how you will account for the effects of these loads in: (a) the dryer stress analysis prior to EPU approval; and (b) the instrumented dryer test plan.

EMCB-SD-RAI-25

The NRC staff experience indicates that minor changes in vessel conditions (static pressure, core flow, and MSL inlet flow rates) can lead to modest (>10%) changes in dryer alternating stresses. Please provide the allowable range of operating conditions at EPU power for the remaining life of the PBAPS Units 2 and 3 (including the historical plant data at CLTP, the methodology for determining the worst-case alternating stresses for all dryer regions over these operating conditions, and the effects of these operating conditions on the remaining fatigue life).

EMCB-SD-RAI-26

Tables 5-3 and 5-4 of Reference 3 show [[

]] However, Table 5-5 of Reference 3 shows [[ ]] whereas Table 5-6 of Reference 3 shows [[ ]] Please provide the frequencies of the [[ ]] in both PBAPS Units. Also provide the motor and pump design specifications, along with any formulas explaining how the [[ ]] are computed based on the pump and motor design parameters.

EMCB-SD-RAI-27

This RAI question has been deleted.

EMCB-SD-RAI-28

Attachment 9 of Reference 4 contains estimates of the PBAPS RSD alternating stresses induced by [[ ]] Please include these stress components in your proposed revision of Reference 4. Also, include the consideration of peak [[ ]] stresses in this forthcoming submission, describing on-dryer instrumentation locations, such that you ensure that a few of the on-dryer strain gages will measure the [[ ]] Provide the spectra of the motor bearing vibration measurements referred to in Reference 4 and discuss the impact on the dryer stresses of any [[ ]] frequency peaks which may be present in the data contained in Reference 4, Attachment 9.

EMCB-SD-RAI-29

Provide the bias errors and uncertainties for all on-dryer instrumentation, including the effects of cabling and data acquisition systems.

EMCB-SD-RAI-30

The NRC performed an audit of the PBAPS RSD data at the Westinghouse office in Rockville, Maryland on September 12, 2013. Please provide an update to Reference 5 which contains all information requested during this audit. Also provide detailed descriptions of the sensor locations, projected and measured spectra, and the correlation of these spectra against the stress regions on the lower and upper dryer, including cumulative strain and pressure plots. Explain what steps will be taken to ensure that the integrity of the sensor/wiring connections is maintained to prevent moisture intrusion and corrupted measurements, particularly for the pressure sensors.

EMCB-SD-RAI-31

Explain how end-to-end benchmarking will be performed using the on-dryer upper and lower strain gages on PBAPS Unit 2.

EMCB-SD-RAI-32

Please provide the limit curves for the on-dryer strain gages for PBAPS Unit 2. Base the curves on the CLTP (not the projected EPU calculations).

EMCB-SD-RAI-33

Please provide details on how you will project dryer minimum alternating stress ratios at higher power levels during power ascension. Also, provide details of how you will address projections that reveal stresses that violate acceptable limits.

EMCB-SD-RAI-34

Provide comparisons of the MSL spectra in PBAPS Unit 2 with those from Quad Cities Unit 2 at comparable EPU power levels. This information should be provided for MSLs with resonances (not all MSLs).

EMCB-SD-RAI-35

The PBAPS RSDs [[ ]] With respect to the fatigue assessment, please provide information showing whether the section properties of the fillet welds are as good as or better than the section properties of the plates being welded. If the fillet weld properties are not equal to or better than that of the plates, provide the following information:

a) Identify which fillet welds are one-sided and which are two-sided.

b) Provide sketches of the different types of fillet welds along with the dimensions.

c) Explain what steps will be taken to estimate the fatigue stress.

EMCB-SD-RAI-36

Since stress convergence errors depend upon the mesh density, the stress gradient, and the local geometry of the RSDs, the stress convergence errors will be different at various locations in the RSDs. According to Section 3 of Reference 6, the finite element model for the PBAPS RSDs [[ ]] Therefore, the stress convergence errors at different locations are likely to be different. Please provide the stress convergence errors for the following locations on the RSDs: (1) locations having high-stress gradients; (2) locations having high stresses at EPU power levels; and (3) at the on-dryer strain gage and accelerometer locations. Additionally, please explain how the stress convergence errors will be accounted for in estimating the stresses in the RSDs at EPU power levels.

EMCB-SD-RAI-37

Please explain whether the speed of the reactor recirculation pumps for PBAPS Units 2 and 3 would change when power is increased from CLTP to the EPU power level during power ascension. Please provide the speeds of the reactor recirculation pumps at CLTP and EPU for each of the PBAPS Units.

EMCB-SD-RAI-38

Please identify if any of the PBAPS RSD WCAP documents will be revised if you to switch from using the Acoustic Circuit Model (ACM) 4.1 Version to the Acoustic Circuit Model Enhanced (ACE) 2.0 Version in the PBAPS RSD load evaluations.

EMCB-SD-RAI-39

Please provide the weights for the PBAPS original equipment manufacturer (OEM) steam dryer and the RSD. Also, address the impact of any increase in weight of the RSD compared to the OEM steam dryer on the reactor pressure vessel (RPV) lugs supporting the RSD and the RPV supports.

EMCB-SD-RAI-40

Please describe how the end-to-end bias and uncertainty for ACE and ACE plus the skirt protection model are determined. Please explain what actions would be taken if the predicted converged peak stresses after being adjusted for the end-to-end bias and uncertainty do not bound the measured stresses at the installed strain gages locations on the RSD.

EMCB-SD-RAI-41

Please provide a proposed license condition for PBAPS Unit 2 that will provide a requirement to: (a) submit a comparison of predicted and measured pressures and strains on the PBAPS Unit 2 RSD near 100% CLTP, 104% CLTP, and 108% CLTP during power ascension; and (b) submit a similar comparison at the EPU power level with the 90 day report following the completion of all EPU power ascension testing for PBAPS Unit 2.

REFERENCES

1) Attachment 17, Enclosure B.1 to Exelon letter to NRC dated September 28, 2012, Westinghouse Report WCAP-17590-P, Revision 0, "Peach Bottom Units 2 & 3 Replacement Steam Dryer Acoustic Load Definition," dated August 2012. (See Note 1 below)

2) Attachment 17, Enclosure B.5 to Exelon letter to NRC dated September 28, 2012, Westinghouse Report WCAP-17611-P, Revision 1, "Peach Bottom Units 2 and 3 Replacement Steam Dryer Four-Line Subscale Acoustics Test Data Evaluation and Derivation of CLTP-to-EPU Scaling Spectra," dated August 2012. (See Note 1 below)

3) Attachment 17, Enclosure B.6 to Exelon letter to NRC dated September 28, 2012, Westinghouse Report WCAP-17626-P, Revision 0, "Peach Bottom Units 2 & 3 MSL Strain Gauge Data and Computation of Predicted EPU Signature," dated August 2012. (See Note 1 below)

4) Attachment 9 to Exelon letter to NRC dated February 15, 2013, "Response to Request for Supplement Information, Issue 2, Steam Dryer Analysis." (See Note 2 below)

5) Attachment 17, Enclosure B.7 to Exelon letter to NRC dated September 28, 2012, Westinghouse Report WCAP-17639-P, Revision 2, "Instrumentation Description for the Peach Bottom Unit 2 Replacement Steam Dryer," dated September 2012. (See Note 1 below)

6) Attachment 17, Enclosure B.2 to Exelon letter dated to NRC dated September 28, 2012, Westinghouse Report WCAP-17609-P, Revision.1, "Peach Bottom Units 2 and 3 Replacement Steam Dryer Structural Evaluation for High-Cycle Acoustic Loads," dated September 2012. (See Note 1 below)

NOTES

1) Attachment 17 to Exelon's letter to the NRC dated September 28, 2012, and its enclosures, contain proprietary information and are non-publicly available. Attachment 15 to the letter, and its enclosures, provide redacted publicly available versions of this information. The letter dated September 28, 2012, and its Attachments are contained in ADAMS Package Accession No. ML122860201.

2) Attachment 9 to Exelon's letter to the NRC dated February 15, 2013, contains proprietary information and is non-publicly available. Attachment 10 to the letter provides a redacted publicly available version of this information. The letter dated February 15, 2013, and its publicly available Attachments are contained in ADAMS Accession No. ML13051A032.