UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 11, 2013

Mr. Michael J. Pacilio
President and Chief Nuclear Officer
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3 - REQUEST FOR ADDITIONAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST FOR EXTENDED POWER UPRATE (TAC NOS. ME9631 AND ME9632)

Dear Mr. Pacilio:

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, and August 29, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML122860201, ML13051A032, ML13129A143, ML13149A145, ML13156A368, ML13182A025, ML13211A457, ML13213A285, ML13217A431, ML13240A002, and ML13241A418, respectively), Exelon Generation Company, LLC (Exelon, the licensee) submitted a license amendment request for Peach Bottom Atomic Power Station, 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, represents an increase of approximately 12.4 percent above the current licensed thermal power level.

The Nuclear Regulatory Commission's (NRC) staff is reviewing your submittal and has determined that additional information is needed to complete its review. The specific questions are found in the enclosed request for additional information (RAI). The RAI questions were provided in draft form to Mr. Kevin Borton of your staff via e-mail on June 24, 2013. The draft questions were sent to ensure that the questions were understandable, the regulatory basis for the questions was clear, and to determine if the information was previously docketed.

A conference call between the NRC staff and the Exelon staff was held on September 10, 2013, to discuss the questions. During the call, Mr. Borton stated that Exelon would provide a response to the RAI questions within 30 days of the date of this letter.

Please note that if you do not respond to this letter by the agreed-upon date or provide an acceptable alternate date in writing, we may reject your application for amendment under the provisions of Title 10 of the *Code of Federal Regulations*, Section 2.108.

If you have any questions, please contact me at (301) 415-1420.

Sincerely,

Richard B. Ennis, Senior Project Manager
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-277 and 50-278

Enclosure:
Request for Additional Information

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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

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, and August 29, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML122860201, ML13051A032, ML13129A143, ML13149A145, ML13156A368, ML13182A025, ML13211A457, ML13213A285, ML13217A431, ML13240A002, and ML13241A418, 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 (CLTP) level.

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: Alexander Tsirigotis

EMCB-RAI-1

Table 1-2 of the Power Uprate Safety Analysis Report (PUSAR)[1] contains information on plant parameters for CLTP conditions and the proposed EPU conditions. The licensee is requested to update Table 1-2 by adding a column for original licensed thermal power (OLTP) conditions. Please include design and maximum temperatures and pressures for the vessel inlet and outlet reactor recirculation system (RRS) nozzles, feedwater (FW) inlet and main steam (MS) outlet, and core spray (CS) inlet.

EMCB-RAI-2

Please verify that the design calculations to demonstrate that systems, structures and components (SSCs) credited to and/or affected by the proposed EPU have been completed and

1 A proprietary (i.e., non-publicly available) version of the PUSAR is contained in Attachment 6 to the application dated September 28, 2012. A non-proprietary (i.e., publicly available) version of the PUSAR is contained in Attachment 4 to the application dated September 28, 2012.

that controlled documentation exists which finds that these SSCs are structurally adequate to perform their intended design functions under EPU conditions.

EMCB-RAI-3

Page 2-41 of the PUSAR states, "For PBAPS, HELB [high-energy line breaks] locations in MS piping inside containment are not based on stress criteria." Please clarify whether the current licensing basis (LB) and design basis (DB) require postulation of pipe failures at specific locations inside containment. If so, please discuss the methodology and criteria used to postulate pipe ruptures inside containment for CLTP and EPU. If the methodology and criteria are different for EPU and CLTP, provide a technical justification that reconciles the differences.

EMCB-RAI-4

Please provide the following:

a) PUSAR page 2-41 lists high energy piping inside and outside containment that could potentially be affected by the proposed EPU. Please provide a justification which demonstrates that plant SSCs (including but not limited to block walls) susceptible to differential pressures resulting from postulated high energy pipe failures inside and outside containment, are capable of maintaining their structural adequacy within DB established limits at EPU conditions.

b) PUSAR Table 2.2-1 shows pressure and temperature increases due to EPU from postulated reactor water cleanup (RWCU) line breaks. Please quantify these increases and provide a technical justification to reconcile these EPU increases on potentially affected SSCs by adding more detail to PUSAR Section 2.2.1.2.1, "RWCU Line Breaks." Specify whether the loads used in the structural calculations of the current analyses-of-record (AOR) bound the loads due to these increases. If not, discuss required structural reevaluations and reconcile any differences from the AOR methodology and criteria used.

EMCB-RAI-5

Question deleted following conference call on September 10, 2013. No response needed.

EMCB-RAI-6

NRC Regulatory Issue Summary (RIS) 2008-30, "Fatigue Analysis of Nuclear Power Plant Components," identified a concern with the simplified single-stress methodology used by some license renewal applicants to perform fatigue calculations and as input for on-line fatigue monitoring programs. This methodology was being used in lieu of the American Society of Mechanical Engineers (ASME) Code, Section III, Subsection NB method which requires licensees to consider all six stress components. Approval of the PBAPS license renewal application was issued on March 2003 (see NUREG-1769), prior to RIS 2008-30. Therefore, please demonstrate and/or confirm that when you are required to perform stress-based fatigue monitoring, in the current and plant licensing renewal period, the methodology used is in accordance with the ASME Section III, Subsection NB, which considers the six stress components.

EMCB-RAI-7

On page 2-59, PUSAR Section 2.2.2.2.2.2, "Structural Evaluation for Affected BOP [balance of plant] Piping," identifies that the design-basis loss-of-coolant-accident hydrodynamic loads are not changed for EPU conditions. Per PUSAR Section 2.6.1.2.1, "Loss-of-Coolant Accident Loads," the vent thrust loads at four locations exceeded the plant-specific vent thrust loads originally calculated during the Mark I Containment long term program by approximately 2.5 percent.

a) Please discuss this discrepancy.

b) Identify the four locations mentioned above. Discuss how the structural evaluations of the affected SSCs have been revised and provide a brief summary of the evaluation results and conclusions.

EMCB-RAI-8

According to the PUSAR, PBAPS meets the NRC-approved General Electric (GE) topical reports CLTR, ELTR1 and ELTR2 requirements for the disposition of the structural integrity of SSCs affected by the proposed EPU. All three topical reports require that structural integrity evaluations of SSCs for EPU show continued compliance with the construction code and standard for these SSCs (including code allowables and analytical techniques) applicable to the current plant licensing basis and that no change to comply with more recent codes and standards will be proposed due to the power uprate (ELTR1, Page 50). Based on the above, for SSCs in PUSAR Section 2.2, "Mechanical and Civil Engineering," including important to safety piping, pipe supports, pressure retaining components and their supports, reactor pressure vessel (RPV) internals and core support structures that were required to be reevaluated due to higher loads resulting at EPU conditions, please provide the following:

a) The code of construction for the SSC installation and design.

b) Justify and discuss why it is required and acceptable to utilize a different code or code edition rather than the code of construction for SSCs that do not require repair or replacement for EPU.

c) For repair/replacement activities, where a different code or code edition rather than the code of construction has been utilized for EPU, discuss whether documented code reconciliation exists that allows the use of this code and verify that the allowable values from the code of construction have been utilized with the reconciled code. Otherwise, provide a technical justification and the supporting basis which demonstrate that the allowance to use alternate codes and allowables other than the construction codes and allowables is acceptable.

EMCB-RAI-9

The PUSAR, starting on page 2-50, states the following:

> The MS and associated branch piping inside and RCPB [reactor coolant pressure boundary] piping outside containment was evaluated for compliance with ANSI B31.1, "Power Piping," 1973 Edition including Summer 1973 Addenda

stress criteria (Reference 39), including the effects of EPU on piping stresses, piping supports including the associated building structure, penetrations, piping interfaces with the RPV nozzles, flanges, and valves. Allowable stress values for MS piping inside containment and associated branch lines were taken from ANSI B31.1 2004 Edition including the 2005 Addendum (Reference 40).

The above statement indicates that the piping was analyzed using the criteria of the 1973 Edition of B31.1, but the allowable stress values were from the 2004 Edition, including the 2005 Addendum of B31.1. Provide a technical justification which demonstrates acceptability of this method.

EMCB-RAI-10

PUSAR, Table 2.2-4a presents maximum stress summaries for the MS piping due to the proposed EPU, which, as identified in the PUSAR, has been reanalyzed to include the turbine stop valve closure (TSVC) transient loading at EPU conditions.

a) The allowable value of 22,500 pounds per square inch (psi) shown for the "sustained + thermal" loading case for the "Units 2/3 Loop D" piping, shown in PUSAR Table 2.2-4a, does not appear to be correct. Please review the allowable values in Table 2.2-4a and verify that the calculated values in that table represent maximum pipe stresses.

b) Provide an explanation for node designation/location similar to that found on Updated Final Safety Analysis Report (UFSAR), Revision 24, Appendix C, Table C.5.7, "Main Steam Piping." Include information or a note that identifies equation loadings (dead weight, pressure, maximum pressure, design earthquake, maximum earthquake, thermal loads, TSVC load, etc.) for each equation used in the summaries, similar to the loadings column found in the UFSAR table. In addition, identify piping inside and outside containment and which service level or equation in the summaries contains the TSVC loading.

c) PUSAR Table 2.2-4a uses the designations "Eq. 13" and "Eq. 14" interchangeably. Please verify whether "Eq. 14" is a typo and is meant to be "Eq. 13". Discuss whether the Node 78 "Sustained + Thermal" allowable of 43,750 psi is for a different material (i.e., A106 GR C) than the material (i.e., A106 GR B) on the remainder of the nodes listed in the table.

d) MS allowable values at all critical locations shown on UFSAR, Appendix C, Table C.5.7, with the exemption of the section of piping to the high pressure coolant injection turbine, are for a material having a hot allowable stress value (S_h) of 17,500 psi (i.e., A106 GR C). The MS allowable values at all locations but one, shown on PUSAR Table 2.2-4a, are for a material having S_h of 15,000 psi (i.e., A106 Gr B). Please provide the MS material designation(s) corresponding to the various piping locations.

e) Not all of the licensing basis criteria identified in the UFSAR, Appendix C, Table C.5.7 are shown to be satisfied in the EPU stress summaries shown in PUSAR Table 2.2-4a. For instance, the maximum stress summaries in the PUSAR use the $2.4x(S_h)$ stress allowable criterion for Level D loadings, while the LB criterion found in UFSAR Table C.5.7 is $2.0x(S_h)$. Using the LB criterion for the level D stress calculated at node 83V of Loop B would produce an EPU interaction ratio of approximately 1.354 greater than the allowed value of 1.00. Please review the LB MS structural criteria found in the UFSAR and demonstrate how these

criteria will be satisfied for the proposed EPU for continued compliance with the current licensing basis.

f) For exceeding the calculated-over-allowable interaction ratio of 1.00, the PUSAR Table 2.2-4a provides the following note:

> Note 2: B31.1 2004 Code reconciliation (Reference 40) allows for interaction ratio of up to 1.14.

Please identify where this interaction ratio is discussed in the B31.1-2004 code and justify its applicability to the PBAPS.

EMCB-RAI-11

In addition to the MS locations listed in the PUSAR Table 2.2-4a, supplement the table with quantitative maximum result summaries inside and outside the primary containment, which show calculated values compared to the LB allowable values, with the highest resulting interaction ratios at critical locations (such as the MS nozzles, MS relief valve flanges, MS supports, MS flued head anchor penetrations, etc.). For the MS containment penetrations, show the maximum results from the penetration structural qualifications, which include loads from both sides of the penetration.

EMCB-RAI-12

For piping affected by the EPU, which is important to safety or is required to withstand a seismic event, please provide the following:

a) A list of piping systems (or portions of piping systems) inside and outside containment, which contain parameters (including temperature, pressure and flow) that have increased at EPU conditions and list the values of these parameters for OLTP, CLTP and EPU. Also show whether the resulting piping loads from these parameters at EPU conditions (including but not limited to loads due to temperature, pressure, flow, transient and mechanical loads) are bounded in the current DB analyses.

b) For piping with loads that are not bounded by the DB AOR, discuss the method of evaluation. If the methods utilized are different than methods in the current LB and DB, provide a technical justification and the supporting basis which demonstrate acceptability of these methods. Please include quantitative summaries of maximum stresses or loads and fatigue usage factors (if applicable) for EPU and OLTP or CLTP (whichever governs for the EPU derived values) with a comparison to the code of construction or LB (UFSAR) allowable values (whichever is applicable). If scaling factors have been used in determining EPU results from OLTP or CLTP analyses, show the scaling factors and discuss the basis of their development. Include only maximum stresses with the highest interaction ratios and data at critical locations (i.e., anchors and flued head anchors, nozzles, penetrations, flanged connections, valve connections, branching pipe connections, pipe supports, etc.). For containment penetrations, show the maximum results from the penetration structural qualifications which include loads from both sides of the penetration.

c) For any piping loads (such as the ones discussed in part (a) and (b) above), that are not included in the current DB analyses, but could potentially occur at EPU conditions and are not included in the EPU piping evaluations, provide an explanation which justifies exclusion of these loads in the EPU evaluations. Also, provide a technical justification which demonstrates that occurrence of these loads on the piping will not challenge the piping system (including all system components such as inline components, supports, anchors, penetrations, nozzles, etc.) and connected SSCs beyond their structural design limits.

EMCB-RAI-13

For safety-related and non-safety-related piping, consider the piping loads discussed in part (c) of EMCB-RAI-12 and demonstrate that additional postulated piping failure locations, in accordance with the LB for the plant, are not required due to these loads that were omitted from the piping analysis.

EMCB-RAI-14

Please verify whether pipe support additions and modifications, for the MS inside and outside of containment, are required only due to the added spring safety valve (SSV) on the MS line "C" and the added TSVC load case in the MS piping analyses for the EPU (which was not considered in the AOR) and that all other pipe loading cases at EPU conditions are bounded by the current AOR. In addition, clarify whether or not MS piping modifications are required due to the EPU, other than the addition of a new SSV. Please provide a discussion which shows the type and number of added supports and briefly discuss the extent of modifications and repairs to the existing supports.

EMCB-RAI-15

For the EPU required additions or modifications that involve SSCs important to safety or required to withstand a seismic event, provide quantitative summaries of the highest resulting interaction ratios (calculated over the DB allowable values) at critical locations. Include structural analysis results, due to structural modifications, which install the safety-related lines for the residual heat removal and high pressure service water cross-ties and the condensate storage tank modification.

EMCB-RAI-16

PUSAR, pages 2-47 and 2-52, show that for EPU, the MS and FW system flows increased by approximately 15 percent over the CLTP values. The PUSAR indicates that in the current DB, neither the MS nor the FW piping structural analyses contained load cases due to flow transients.

For the EPU, the MS piping structural analyses were reconciled for loads due to flow transients by reanalysis, which included a load case due to the TSVC transient that bounds the other MS transients. As a result of accounting for flow transient loads in the MS piping, additional supports and modifications to existing supports were required to structurally qualify the MS piping and maintain it within its LB and DB established allowable limits.

In the case of the FW system, the only justification offered in the PUSAR for the effect of the flow transient loads, at the higher EPU flow rates, on the structural integrity of piping and connecting SSCs, is that these flow transient loads have no effect on the piping because they were not included in the original piping evaluations. The NRC staff considers that this justification does not provide reasonable assurance that potentially affected SSCs will be able to maintain their structural integrity under EPU operation with the increased FW flow rates. Please evaluate the effect of water hammer loads, due to events such as control valve closures and feed pump trips, at EPU flows, on pipe stress, pipe breaks, and pipe supports and demonstrate that the structural integrity of the SSCs that could potentially be impacted by water hammer loads, including piping, pipe supports, nozzles, penetrations and connecting SSCs, will be maintained within LB and DB established allowable limits when operating under EPU conditions.

EMCB-RAI-17

The PUSAR provides a summary of the EPU evaluation for the safety-related thermowells and probes, including a quantitative summary of the calculated vibratory stresses compared to ASME allowable values. The discussion in the PUSAR indicates that it has followed guidance provided in ASME Section III, Appendix N.

a) Please verify that the allowable values have been derived using guidance from Part 3 of the ASME operation and maintenance (O&M) standards and guidelines.

b) With regard to the safety-related thermowells and probes, the PUSAR makes the following statements on page 2-47.

> To calculate the structural response, a non-dimensional parameter, termed reduced damping (Reference 38, N-1324.1 Equation 76), was calculated:
>
> For off resonance (non lock-in) condition, the structural response is ordinarily small and was calculated using the standard method (Reference 38, N-1324.2, first paragraph)

Provide a quantitative summary of reduced velocity and reduced damping values, in accordance with the requirements from ASME Appendix N, subparagraph N-1324.1, to demonstrate that synchronization (lock-in) of the periodic vortex shedding frequencies to the structural natural frequency of the instrument can be prevented.

EMCB-RAI-18

With regard to the vibration of piping due to MS and FW increased flow rates and flow velocities, Section 2.2.2.1.2 of the PUSAR states that EPU vibration levels may increase by up to 54 percent of OLTP. In previous power uprates reviewed by the NRC staff, the licensees reviewed existing measured vibration data from plant startups. Vibration data were also collected at several power levels during the power ascension following outages, prior to EPU. Measured vibration data from initial startup and prior to EPU outages (such as stretch power uprate or other refueling outages) formed a baseline from which vibration data were projected to EPU conditions. This projected data was used to determine piping vibration susceptibility and to prepare any needed modifications prior to EPU power ascension. The modifications ranged from new supports and modifications to existing supports, as well as piping modifications.

Please discuss in detail the work that has been performed at PBAPS Units 2 and 3 to evaluate the EPU-impacted small bore and large bore piping systems for vibration susceptibility in order to identify whether piping and pipe support modification are required prior to EPU power ascension. Please supplement Attachment 13, "Flow Induced Vibration," Tables 3-1, 3-2, 3-3 and 3-4 of the EPU application with EPU projected vibrations and the existing measured vibrations (that were utilized for the EPU projections) compared to acceptance criteria. Otherwise, provide a justification for not having completed a baseline vibration monitoring for selected systems and components and for not having identified piping vibration vulnerability prior to EPU ascension.

EMCB-RAI-19

Please provide the following:

a) In the current design basis of the plant, are there any piping analyses that contain stratification and is there any CLTP stratification monitoring currently in place? Please list these stratification locations.

b) Explain how these stratification locations have been evaluated and accepted for the EPU conditions and provide a summary of their evaluation results.

EMCB-RAI-20

Discuss the structural evaluation of the vessel supporting structure and its components due to potentially higher EPU loads.

EMCB-RAI-21

In PUSAR Table 2.2-7 for FW and recirculation nozzles, clarify whether the column labeled as "EPU with Environmental Fatigue U_{en})" is for 60-year plant life. Discuss why these EPU fatigue cumulative usage factor values are less than the values in column marked "EPU/(4030 MWt)" which do not contain environmental effects.

EMCB-RAI-22

GE Hitachi Nuclear Energy (GEH) issued 10 CFR Part 21 Safety Information Communication (SC) 09-03 on the subject of Shroud Screening Criteria Reports. SC09-03 lists PBAPS (Unit 2 and Unit 3) as two of the affected plants for the shroud screening criteria flaw evaluations, due to the omission of the postulated Recirculation Line Break loads (transient acoustic or steady state flow-induced loads) in the DB evaluation for the shroud screening criteria reports, which could potentially result in allowable flaw lengths of shroud welds to be smaller than those provided in the shroud screening criteria reports. Please discuss the impact of GEH Safety Information Communication SC09-03 on the PBAPS Units 2 and 3 core shrouds.

EMCB-RAI-23

Provide a summary of the evaluation that qualified the core plate plugs for operation at the EPU conditions.

EMCB-RAI-24

Provide a justification to demonstrate that the increased radiation exposure due to EPU is within the radiation damage threshold of the nonmetallic parts such as in valves, hydraulic snubbers and nonmetallic flexible joints

If you have any questions, please contact me at (301) 415-1420.

Sincerely,

/ra/

Richard B. Ennis, Senior Project Manager
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
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