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

July 1, 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, and June 4, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML122860201, ML13051A032, ML13129A143, ML13149A145, and ML13156A368, 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 5, 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 June 27, 2013, to discuss the questions. During this call, Mr. Borton stated that Exelon would provide a response to all of the RAI questions (except SCVB-RAI-25) within 30 days of the date of this letter. Mr. Borton stated that a response to SCVB-RAI-25 would be provided within 60 days of the date of this letter.

Please note that if you do not respond to this letter by the agreed-upon dates or provide acceptable alternate dates 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

cc w/encl: Distribution via ListServ

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, and June 4, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML122860201, ML13051A032, ML13129A143, ML13149A145, and ML13156A368, 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.

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.

Containment and Ventilation Branch (SCVB)
Reviewer: Ahsan Sallman

SCVB-RAI-1

For the parameters shown in the table below, please provide the current analysis input values and the EPU analysis input values used for the short-term double-ended guillotine Recirculation Loop Suction Line Break (RSLB) Design-Basis Loss-of-Coolant Accident (DBLOCA) containment pressure response analysis which resulted in a drywell peak pressure of 50.4 pounds per square inch gauge (psig) (under EPU conditions) as shown in Table 2.6-1 of the Power Uprate Safety Analysis Report (PUSAR[1]). Provide justification for the differences between the current and the EPU analysis input value if the EPU value is less conservative. Also justify that the EPU value used for the analysis remains conservative for the peak drywell pressure response.

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.

Parameter	**Current analysis input value**	**EPU analysis input value**	**Justification for differences between current and EPU analysis input value if the EPU value is less conservative**
RSLB critical flow model			
Break flow area			
Decay heat model			
Percentage of initial reactor thermal power			
Initial reactor pressure			
Initial containment pressure			
Initial containment temperature			
Initial containment relative humidity			
Initial suppression pool level			
Initial suppression pool temperature			
Initial downcomer submergence height			
Downcomer pressure loss coefficient			
Drywell holdup volume			
Time from scram at which Main Steam Isolation Valve (MSIV) starts to close			
MSIV closure time			
Time from scram at which Feedwater (FW) isolation valve starts to close			
FW valve closure time			
FW temperature			
Drywell free volume			
Wetwell free gas space volume			
Initial suppression pool volume			
Initial suppression pool height			
Total core spray flow to reactor			
Time of core spray initiation from reactor scram			
Total Low Pressure Coolant Injection (LPCI) flow to reactor			
Time of LPCI initiation from reactor scram			

SCVB-RAI-2

For the parameters shown in the table below, please provide the current analysis input values and the EPU analysis input values used for the long-term Small Steam Line Break (SSLB) LOCA analysis that resulted in the most limiting peak suppression pool temperature of 187.6 °F for the Net Positive Suction Head (NPSH) analysis, and a peak drywell temperature of 340 °F for the drywell equipment environment qualification (EQ), as shown in Table 2.6-1 of the PUSAR. Provide justification for the differences between the current and the EPU analysis input value if the EPU value is less conservative. Also justify that the EPU values used for the analysis remain conservative for the peak drywell and suppression pool temperatures.

Parameter	Current analysis input value	EPU analysis input value	Justification for differences between current and EPU analysis input value if EPU value is less conservative
SSLB critical flow model			
Break flow area			
Decay heat model			
Percentage of initial reactor thermal power			
Initial containment pressure			
Initial containment temperature			
Initial containment relative humidity			
Initial suppression pool level			
Initial suppression pool temperature			
Initial downcomer submergence height			
Downcomer pressure loss coefficient			
Drywell holdup volume			
Time from scram at which MSIV starts to close			
MSIV closure time			
Time from scram at which FW valve starts to close			
FW valve closure time			
FW temperature			
Drywell free volume			
Wetwell free gas space volume			
Initial suppression pool volume			
Initial suppression pool height			

Parameter	Current analysis input value	EPU analysis input value	Justification for differences between current and EPU analysis input value if EPU value is less conservative
Residual Heat Removal (RHR) heat exchanger K-value			
RHR operating mode (spray or pool cooling)			
RHR heat exchanger hot side flow			
RHR heat exchanger cold side flow			
Total core spray flow to reactor			
Total High Pressure Coolant Injection (HPCI) flow to the reactor			
Thermal conductor shape (for example wall, hollow cylinder, or rod)			
Thermal conductor material of each shape			
Thermal conductor heat transfer area of each shape			
Thermal conductor heat transfer coefficient for each shape			

SCVB-RAI-3

Section 2.6.1 of the PUSAR states all the assumptions used to maximize the drywell pressure response in the short-term analysis. Explain the basis for the assumed vent system pressure loss coefficient used in the analysis to maximize the peak drywell pressure during the initial blowdown period.

SCVB-RAI-4

Section 2.6(a) of General Electric Licensing Topical Report NEDC-32424P-A, "Generic Guidelines for General Electric BWR Extended Power Uprate," dated February 1999, (ADAMS Accession No. ML003680231) states:

> The [Super Hex] SHEX computer code for the calculation of suppression pool response to LOCA events has been approved (Reference 7) on a plant-specific basis, provided that confirmatory calculations for validation of the results were included in the plant-specific request.

Please describe how the plant-specific benchmark confirmatory calculation results, validating the use of the SHEX code, was addressed for the PBAPS long-term containment analysis.

SCVB-RAI-5

Table 2.6-1 of the PUSAR shows that the Design case (D) peak drywell pressure of 50.4 psig is greater than the Bounding case (B) peak drywell pressure of 48.7 psig. As per footnote 7 of Table 2.6-1, the Design case assumes an initial containment pressure of 2.5 psig and an initial drywell temperature of 70 °F. The Bounding case assumes an initial containment pressure of 2.0 psig and an initial drywell temperature of 125 °F. This implies that a conservative drywell pressure response analysis uses a maximum Technical Specification (TS) initial drywell pressure, and a minimum possible drywell temperature.

a) Please provide and justify the values of initial drywell pressure, initial drywell temperature and relative humidity for conservative calculation of the peak drywell pressure 'Pa' for 10 CFR Part 50 Appendix J leak rate testing.

b) What is the most conservative value of Pa?

SCVB-RAI-6

As discussed in PUSAR Section 2.6.3.1.1, the calculated peak drywell wall temperature of 281 °F is the same as the design temperature. Please explain the method of calculating the wall temperature based on the peak drywell gas temperature of 340 °F, including the assumptions used for conservative results. What is the limiting drywell wall temperature obtained from dual unit interaction analysis? In case it has the same value (i.e., 281 °F) as obtained from the single unit analysis, please justify why it is the same.

SCVB-RAI-7

In Section 2.6.5.1 of the PUSAR, the second sentence on page 2-272 states:

> The performance testing acceptance criteria will be revised based on the EPU analyses to reflect the minimum acceptable heat removal capability that is greater than the value assumed in the analyses.

a) Please describe the testing frequency, the current and EPU acceptance criteria for the RHR heat exchanger performance testing, and explain the basis of the EPU acceptance criteria.

b) Describe if there are different required RHR heat exchanger performance values (K value) for different events.

c) Please confirm that the heat exchanger heat removal rate acceptance criteria bounds the required heat removal capacity for the most limiting event in item (b) above.

d) Describe the Generic Letter (GL) 89-13 testing for the RHR heat exchangers and discuss the accuracy of the testing with respect to design conditions. With a lower heat transfer margin for the RHR heat exchangers, please justify your reliance of GL 89-13 testing as a means of assuring that the required heat transfer capability of the RHR heat exchangers is maintained.

SCVB-RAI-8

With respect to Section 2.6.5.1 of the PUSAR, under the heading "Pool Temperature Response - RSLB DBLOCA:"

a) Please explain the reasons for assuming interruption of containment cooling for 10 minutes in the accident unit due to dual unit interaction when the accident unit suppression pool temperature is 10 °F below its peak reached if there was no interruption in its containment cooling.

b) What is a realistic expected containment cooling interruption time during a RSLB DBLOCA scenario compared to the 10-minute assumption used in the analysis?

SCVB-RAI-9

Section 2.6.5.1 of the PUSAR, under the heading "Pool Temperature Response – RSLB DBLOCA," states in the last paragraph on page 2-274 that:

> The results of this evaluation of the second PBAPS (non-accident) unit response is applicable and bounding for small break LOCAs and other accidents/events on the other PBAPS unit because the scenario includes a bounding dual unit interaction and uses the minimum equipment available to reach cold shutdown.

Please explain why the dual unit interaction shutdown cooling analysis for the non-accident bounds the same analysis results for small break LOCAs and "other accident /events." What are the other accident/events considered for which this analysis is bounding?

SCVB-RAI-10

Section 2.6.5.1 of the PUSAR, under the heading "Pool Temperature Response - Loss of RHR Normal Shutdown Cooling Function Event," states on page 2-276 that:

> Accomplishing [Alternate Shutdown Cooling] ASDC using either [Suppression Pool Cooling] SPC or [Containment Spray Cooling] CSC modes would be expected to take slightly longer to achieve cold shutdown. However, the time to achieve cold shutdown assuming [Containment Injection Cooling] CIC is significantly earlier than the acceptance limit time of 36 hours. Therefore additional analysis runs using either SPC or CSC modes were considered unnecessary.

A similar statement is made on page 2-277, which describes the dual unit interaction analysis.

Please explain why the ASDC using the SPC or CSC mode would take longer time than the CIC mode to attain cold shutdown in the single unit analysis or the dual unit interaction analysis.

SCVB-RAI-11

Section 2.6.5.1 of the PUSAR, under the heading "Pool Temperature Response - Loss of RHR Normal Shutdown Cooling Function Event," states on the bottom of page 2-276 that:

> A second interruption of containment cooling on the Loss of [Normal Shutdown Cooling] NSDC Event unit is assumed due to dual unit interaction when the Loss of NSDC Event unit suppression pool temperature is 10 °F below the peak suppression pool temperature that would be experienced by the Loss of NSDC Event unit if there was no containment cooling interruption due to dual unit interaction.

Please describe the reasons for assuming a second interruption in the containment cooling of the Loss of NSDC Event unit.

SCVB-RAI-12

With respect to Section 2.6.5.1 of the PUSAR, under the heading "Pool Temperature Response - Small Steam Break LOCA:"

a) The sequence of items and operator actions assumed for the single unit analysis does not mention about the occurrence of a LOCA signal in the accident unit. Please describe the sequence including the timing of the LOCA signal assumed in the analysis.

b) The second paragraph on page 2-277 states in the last sentence that:

> For smaller steam breaks, HPCI may be available for vessel makeup, but is not credited for 10 minutes to ensure a bounding DW temperature is evaluated.

Please explain why the drywell temperature calculated is bounding by not crediting the HPCI operation for the first 10 minutes in the single unit analysis.

c) The third paragraph on page 2-277, states in the first sentence that:

> At 10 minutes, operators turn off two of the RHR pumps, and align the remaining RHR pump to provide containment cooling with a flow of 8600 gpm through one RHR heat exchanger...

Please describe at what point in time the RHR pumps start and in which operating mode of the RHR system.

SCVB-RAI-13

With respect to Section 2.6.5.1 of the PUSAR, under the heading "Pool Temperature Response - Small Steam Break LOCA:"

a) The last paragraph on page 2-278 states:

> At 10 minutes, operators turn off two of the RHR pumps and align the remaining RHR pump to provide containment cooling using with a flow of 8600 gpm through one RHR heat exchanger...

Please describe at what point in time the RHR pumps start and in which operating mode of the RHR system.

b) Please describe the sequence assumed in the non-accident unit for the dual unit interaction analysis.

c) What is the peak drywell temperature calculated in the accident unit in the dual unit interaction analysis? Provide justification in case it is bounded by the maximum peak drywell temperature 340 °F for EQ obtained from the single unit SSLB LOCA analysis.

SCVB-RAI-14

Section 2.6.5.2 of the PUSAR, states on page 2-282 that:

> The CIC mode of ASDC results in the highest suppression pool temperature response and therefore provides a more conservative suppression pool temperature input for the NPSH evaluation of the [Core Spray] CS pump than does the SPC mode of ASDC operation.

Please note that the CIC mode of ASDC uses the RHR pump for suppression pool cooling and cooling of reactor pressure vessel (RPV) water. The above statement refers to the CS pump instead of the RHR pump. Please clarify the statement or provide justification of the use of CS pumps in the CIC mode.

SCVB-RAI-15

Section 2.6.5.2 of the PUSAR, states on page 2-282 that:

> HPCI is also assumed to operate during this event, with an assumed primary water suction source from the suppression pool, to provide RPV inventory make-up with reactor pressure above the HPCI isolation pressure. The assumption of HPCI operation is conservative for the determination of peak suppression pool temperature.

Please explain why the assumption of using HPCI to provide RPV makeup is conservative for determining the peak suppression pool temperature.

SCVB-RAI-16

Section 2.6.5.2 of the PUSAR mentions various Appendix R cases (A1, A2, B1, B2, D1, D2, C1A, C2A, C1B, and C2B). Section 2.11.1.2.2 of the PUSAR mentions the four Appendix R safe shutdown methods A, B, C, and D. Please provide a description of the cases A1, A2, B1, B2, D1, D2, C1A, C2A, C1B, and C2B analyzed for NPSH and how they are related to the safe shutdown methods A, B, C, and D.

SCVB-RAI-17

With respect to Section 2.6.2 of the PUSAR, please provide a more detailed description of the Sacrificial Shield Wall (SSW) annulus pressurization and SSW plug jet impingement analysis for a Feedwater Line Break inside the annulus. List the assumptions justifying that they are conservative. Provide the analysis results and the design margin.

SCVB-RAI-18

The last paragraph under "Technical Evaluation," in Section 2.6.2 of the PUSAR states:

> With consideration of steam flashing for AP and the jet pressure (impingement on shield plug), the results of the updated conditions including the effects of the EPU and the off-rated conditions indicate that the design limit for shield plug pressure difference is not exceeded.

a) Please explain the statement: "With consideration of steam flashing for AP and the jet pressure (impingement on shield plug)..."

b) Describe the off-rated conditions.

SCVB-RAI-19

Section 2.6.1.2.2 of the PUSAR states that EPU reduces the time between subsequent safety relief valve (SRV) actuations.

a) What are the times between the first and the second actuation and between the subsequent actuations in the current analysis and the EPU analysis?

b) What is the time at which the equilibrium height is re-established after the SRV closes in the current and the EPU analysis?

c) Describe the EPU changes in the SRV logic which prevent subsequent SRV actuations until after the SRV discharge reflood level stabilizes to the equilibrium height to prevent higher SRV and SRV discharge line loads.

SCVB-RAI-20

Section 2.6.1.2.3 of the PUSAR states:

> The current PBAPS Mark 1 Long Term Program Plant Unique Analysis (Reference 71) determines that the maximum internal pressure and thermal loads for the torus occur during an [Intermediate Break Accident] IBA.

The above statement addresses the current analysis instead of EPU analysis. Please note that the EPU conditions could have changed as to which break (i.e., DBLOCA, IBA, or SBA) determines the maximum internal pressure and thermal loads for the torus. Please describe the impact of the DBLOCA, IBA, and SBA analyses at EPU conditions on internal pressure and thermal loads for the torus.

SCVB-RAI-21

Section 2.6.1.5 of the PUSAR states:

> Under EPU conditions, sufficient overpressure in the cooling water lines is maintained, thereby preventing water hammer under [design-basis accident] DBA conditions.

Please describe in more detail what kind of water hammer could potentially occur in the cooling water lines and how it is prevented.

SCVB-RAI-22

Section 2.6.6 of the PUSAR, under "Technical Evaluation," states on page 2-288 that:

> Because the maximum dome pressure is also not changed for EPU, there is no effect to the ability of secondary containment to contain mass and energy released to it. There is no increase in mass and energy released to secondary containment for EPU.

a) Please explain what is meant by "ability of secondary containment to contain mass and energy released to it."

b) Which break mass and energy released in the secondary containment is being referred to in the above statement?

c) Explain how the reactor dome pressure affects the ability of the secondary containment mass and energy released to the secondary containment.

SCVB-RAI-23

In Section 2.7.6 of the PUSAR, the Technical Evaluation states that the operating heat load in the standby diesel generator rooms will increase slightly, but is bounded by the design heat load with enough margin available to maintain design temperatures. Please describe the changes due to EPU affecting the diesel generator building heat load during normal and accident conditions.

SCVB-RAI-24

With respect to Tables 9-2a, 9-2b, 9-2c, and 9-2d of Attachment 9 to the application dated September 28, 2012:

a) Provide the reasons for assuming that an EPU initial drywell temperature of 70 °F as opposed to 145 °F in the current licensing basis for the NPSH analysis for DBA LOCA , SSLB, loss of RHR normal shutdown cooling with loss of offsite power, and the SRV transient (Tables 9-2a, 9-2b, and 9-2c) would maximize the suppression pool temperature response. Explain why assuming an initial drywell temperature of 145 °F was conservative in the current licensing basis and why 70 °F is conservative for the EPU analysis for the suppression pool temperature response.

b) Explain the basis for choosing 70 °F for the EPU instead of any other value that would maximize the suppression pool temperature for the accidents and events listed above.

c) Provide the reasons for keeping the initial drywell temperature for EPU SBO NPSH analysis (Table 9-2d) 145 °F the same as in the current licensing basis.

SCVB-RAI-25

For an "Appendix R Fire" event, Regulatory Guide (RG) 1.189 Revision 2 provides guidance regarding consideration of spurious equipment actuation due to fire-induced failure of associated circuits to prevent the loss of safe shutdown capability including the loss of containment cooling function. This RG endorses the approach outlined in Chapter 4 of NEI 00-01 Revision 2 which relies on the Expert Panel Process and the Generic List of Multiple Spurious Operations (MSOs) contained in Appendix G to that document. It provides an acceptable methodology for the identification of multiple spurious actuations that may affect safe shutdown success path systems, structures, and components, when applied in conjunction with RG 1.189.

Consistent with the guidance in RG 1.189 and NEI 00-01 Appendix G, Revision 2, please provide a discussion of the EPU evaluation of fire-induced MSOs and prevention of the loss of safe shutdown and containment cooling capability during an Appendix R Fire event. Also address the PBAPS applicable plant-specific scenarios listed in Table G-1 of NEI 00-01 Revision 2.

SCVB-RAI-26

Note 5 in Table 2.6-1 of the PUSAR sentence states, in part, that:

> A peak bulk suppression pool temperature of 187 °F was calculated for the SSLB LOCA analysis performed for maximum drywell temperature for EQ, and is therefore the most limiting peak bulk suppression pool temperature for all LOCA break sizes.

Section 2.6.5.1 of the PUSAR under the heading "Pool Temperature Response - Small Steam Break LOCA", last paragraph on page 2-279 reports a peak suppression pool temperature of 187.6 °F, which is obtained from the SSLB LOCA dual unit interaction analysis. Please provide reasons for considering 187 °F to be the most limiting peak bulk suppression pool temperature for all LOCA break sizes instead of 187.6 °F.

SCVB-RAI-27

Section 2.7.3 of the PUSAR, under "Technical Evaluation" states that electrical or electronic equipment will be added in the cable spreading room due to the adjustable speed drive (ASD) modification. Please provide the final design increase in the heat load due to the planned addition of the ASDs and the impact of additional heat load on the design capacity of the control room HVAC system.

SCVB-RAI-28

In Section 2.7.5 of the PUSAR, the Technical Evaluation states that the main steam tunnel temperature increase will be less than 0.5 °F at EPU conditions. Please describe the method of evaluation of the increase in the main steam tunnel temperature at EPU conditions.

SCVB-RAI-29

Section 2.8 of Attachment 9 to the application states that all six (three per unit) condensate pumps and motors will be upgraded. The Technical Evaluation in Section 2.7.5 of the PUSAR states that "[t]he effect of condensate pump upgrades on HVAC systems will be evaluated as part of the normal modification process." Please provide the final design increase in heat load due to the condensate pump upgrades and the impact of increased heat load on the design capacity of turbine building HVAC system.

SCVB-RAI-30

In Section 2.7.5 of the PUSAR, the Technical Evaluation does not provide a discussion of the increased HVAC heat load due to increase in the power dependent fuel pool cooling system heat load. Please provide the impact of the increased fuel pool heat load on the reactor building HVAC heat load and its HVAC design capacity.

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
Office of Nuclear Reactor Regulation

Docket Nos. 50-277 and 50-278

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