REQUEST FOR ADDITIONAL INFORMATION

REGARDING PROPOSED LICENSE AMENDMENT

EXTENDED POWER UPRATE

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

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, and June 27, 2013, (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML122860201, ML13051A032, ML13129A143, ML13149A145, ML13156A368, and ML13182A025, 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.

Reactor Systems Branch (SRXB)
Reviewer: Diana Woodyatt

Fuel and Core Design

SRXB RAI-2

Section 2.8.2.1 of the Power Uprate Safety Analysis Report (PUSAR[1]) indicates that the average bundle power would increase from the current licensed thermal power (CLTP) value of 4.60 Megawatts (MW)/bundle to a value of 5.17 MW/bundle under EPU conditions. This 12.4% change in average bundle power level corresponds to the same percent increase of total core power from CLTP to EPU conditions. For constant pressure power uprate (CPPU) for boiling-water reactors (BWRs), it is assumed that the additional core power is obtained by flattening the core power profile (i.e., raising the average bundle power, but keeping the peak bundle power the same). However, past BWR EPU operations have demonstrated that peak bundle power can increase by a limited amount. Please provide the current peak bundle power level and the expected value of peak bundle power for EPU operation at PBAPS.

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[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.

SRXB RAI-3

As stated in the PUSAR, PBAPS EPU analyses assumed a representative “equilibrium” core comprised of GNF2 fuel only. Describe the PBAPS core design for the first EPU cycle. If the actual EPU core will be comprised of other GE fuel designs, for example GE14, in addition to GNF2, then justify why using a GNF2 equilibrium core for EPU calculations provides bounding results for EPU transient and accident analyses, in particular the safety limits (minimum critical power ratio (MCPR), linear heat generation rate, maximum average planar linear heat rate, peak cladding temperature (PCT), etc.).

SRXB RAI-4

Pellet clad interaction (PCI) and stress corrosion cracking (SCC) phenomena can cause clad perforation resulting in leaking fuel bundles and resultant increased reactor coolant activity. Therefore, the NRC staff requests the licensee to provide the following additional information regarding PCI/SCC for PBAPS at EPU conditions:

a) Describe any differences in operating procedures associated with PCI/SCC at EPU conditions versus pre-EPU operations.

b) From the standpoint of PCI/SCC, discuss which of the Anticipated Operational Occurrences (AOOs), if not mitigated, would most affect operational limitations associated with PCI/SCC.

c) For the AOOs in part (b), discuss the differences between the type of required operator actions, if any, and the time to take mitigating actions between pre-EPU and EPU operations.

d) If the EPU core will include fuel designs with non-barrier cladding which have less built-in PCI resistance, then demonstrate by plant-specific analyses that the peak clad stresses at EPU conditions will be comparable to those calculated for the current operating conditions.

e) Describe operator training on PCI/SCC operating guidelines.

Thermal-Hydraulic Design and Anticipated Transients Without SCRAM

SRXB RAI-5

Characterize the expected amount of bypass voiding under CPPU conditions. Provide the expected bypass void level at points C, D, and E of Figure 1-1 of the PUSAR, using a methodology equivalent to that used by ISCOR for both hot and average channel.

SRXB RAI-6

Reliability of the local power range monitor (LPRM) instrumentation and accurate prediction of in-bundle pin powers typically requires operation with bypass voids lower than 5% at nominal conditions (e.g., point E of Figure 1-1 of the PUSAR). If the expected bypass void conditions at CPPU are greater than 5%, evaluate the impact on: (1) reliability of LPRM instrumentation, (2) accuracy of LPRM instrumentation, and (3) in-bundle pin powers.

SRXB RAI-7

The presence of bypass voids affects the LPRM calibration. Evaluate the expected calibration error on Oscillation Power Range Monitor (OPRM) and Average Power Range Monitor cells induced by the expected level of bypass voids. Document the impact of this error on the detect-and-suppress Option III scram setpoint.

SRXB RAI-8

PUSAR Table 2.8-2 only shows the Option III Setpoints Demonstration. Please provide an example setpoint calculation for the EPU cycle including an uncertainty term reflecting the possible LPRM miscalibration under bypass void conditions.

SRXB RAI-9

The Delta Critical Power Ratio (CPR) over Initial CPR Versus Oscillation Magnitude (DIVOM) slope is not included in PUSAR Table 2.8-2 under CPPU conditions. Please document which DIVOM slope will be used for future CPPU cycles and which methodology will be used to: (1) calculate it, or (2) evaluate the adequacy of an older slope.

SRXB RAI-10

Assuming a conservative OPRM setpoint of 1.15, provide the hot-spot fuel temperature as a function of time before the scram. Evaluate this fuel temperature oscillation against PCI limits. Assume that the steady-state fuel conditions before the oscillations are those of point A1 of PUSAR Figure 2.8-21 (the highest power point in the backup stability protection (BSP) scram region).

SRXB RAI-11

Describe any effects or impacts of EPU on the long-term stability implementation.

SRXB RAI-12

For the BSP calculations, describe how the stability curves for the scram region and the controlled entry region shown in PUSAR Figure 2.8-21 are calculated for EPU conditions. Specifically, provide the associated feedwater temperature assumptions that allow the use of the same decay ratio criteria shown in Table 2.8-3 for the Scram and Controlled Entry boundary.

SRXB RAI-13

Provide plant-specific information relevant to an anticipated transient without scram (ATWS) event under EPU conditions. Specifically, provide the location of the boron injection, a description of the standby liquid control system actuation logic and its operability requirements, boron enrichment level, turbine bypass capacity, and location of the steam extraction points for the feedwater heaters.

SRXB RAI-14

Provide a short summary of the Solution III hardware currently installed in PBAPS. Provide justification that the hot channel oscillation magnitude portion of the Option III calculation is not affected by EPU because the OPRM hardware does not change.

SRXB RAI-15

Provide a summary of the ATWS emergency operating procedure (EOP) actions. What version of emergency operating guidelines is currently implemented in PBAPS? Provide a short description of the process used to ensure that the emergency procedure guideline variables (e.g., hot shutdown boron weight, heat capacity temperature limit, etc.) are adequate under CPPU conditions.

SRXB RAI-16

Provide a short description of how the Stability Mitigation Actions (e.g., immediate water level reduction and early boron injection) are implemented in PBAPS. Does operation at CPPU conditions require modification of any operator instructions?

SRXB RAI-17

PBAPS currently operates under the Option III solution. Please provide clarification for the following areas:

a) Describe the process that was followed by PBAPS to implement Option III Long-Term Stability Solution and to verify that Option III is still applicable under CPPU operation.

b) Describe the expected effects of CPPU operation on Option III.

c) Describe any alternative method to provide detection and suppression of any mode of instability other than through the current OPRM scram.

d) Provide a summary of the PBAPS Technical Specifications affected by the Option III implementation and future CPPU operation.

e) List the approved methodologies used to calculate the OPRM setpoint by the current operation and future PBAPS CPPU operation.

SRXB RAI-18

Provide a table of hot channel and core-wide decay ratios at the most limiting state point for the last cycles and the proposed CPPU condition. The purpose is to evaluate the impact of CPPU on relative stability of the plant, and the applicability of Option III to PBAPS under these new conditions.

SRXB RAI-19

Describe the effects or impacts, if any, of EPU on suppression pool cooling during isolation ATWS events and/or EOPs.

SRXB RAI-20

Please provide a short description of the simulator neutronic core model. Also, provide the schedule to show when the PBAPS simulator will be upgraded for EPU conditions.

SRXB RAI-21

PUSAR Section 2.8.5.7.3 states that the highest calculated PCT for ATWS events is 1342 °F, during the Pressure Regulator Failure Open event. The submittal states that:

> Local cladding oxidation is not explicitly analyzed because, with PCT less than 1600 °F, cladding oxidation has been demonstrated to be insignificant compared to the acceptance criteria of 17% of cladding thickness. Therefore, the local cladding oxidation for the PBAPS ATWS events is qualitatively evaluated to show compliance with the acceptance criteria of 10 CFR 50.46.

Please provide a reference to show where cladding oxidation has been demonstrated to be insignificant when the PCT is less than 1600 °F during ATWS events.

Emergency Systems

SRXB RAI-22

With respect to overpressure protection (i.e., Section 2.8.4.2 of the PUSAR), if an analysis was performed for the Turbine Trip with Bypass Failure and Scram on High Flux (TTNBPF) event, as it is required in Table E-1 of ELTR-1, please provide a plot comparing the pressure transients for the Main Steam Isolation Valve Closure with Scram on High Flux and the TTNBPF events. If a TTNBPF analysis was not performed for EPU, then justify why not.

SRXB RAI-23

Do the decay heat removal requirements change between current and EPU power levels due to any changes in decay heat load or suppression pool temperature? If so, what are the new requirements and how does the reactor core isolation cooling (RCIC) system meet the new criteria without updating the system performance?

SRXB RAI-24

Table 4.7.1 in the PBAPS Updated Final Safety Analysis Report (UFSAR) shows that the RCIC system pump has a design temperature range of 40 °F to 140 °F. Are there any instances under EPU conditions where the pump would be operating outside of this temperature range? If so, what are the conditions and how are they addressed for this EPU?

SRXB RAI-25

What is the effect on net positive suction head for the reactor recirculation system for EPU? The PUSAR stated this result is based on past uprate analyses. Explain the past analyses and their relevance.

Accident and Transient Analyses

SRXB RAI-26

Section 2.8.5.6.2.5 of the PUSAR states that the licensing basis PCT is 1925 °F based on the most limiting Appendix K case, including a variable plant uncertainty term. Please provide further explanation regarding the "plant variable uncertainty term."

SRXB RAI-27

Page 2-396 of the PUSAR states that, independent of the EPU, the licensee will be replacing the recirculation system pump motor power supplies from motor/generator set power supplies to adjustable speed drives (ASDs). Section 2.8.5.2.1 of the PUSAR discusses Loss of External Load and Turbine Trip events with specific evaluations for the Generator Load Rejection with Steam Bypass Failure (LRNBP) event and the Trip with Steam Bypass Failure event. Results of the transient analysis, shown in PUSAR Table 2.8-12, indicates that LRNBP is the limiting event with a delta CPR of 0.27. Section 2.8.5.2.1 indicates that, [[

]] Please specify the resulting delta CPR
[[ ]]

Operating Experience

SRXB RAI-28

Recent operating experience has shown that, at a similar BWR/4, the events that follow a loss of stator cooling (LOSC) could cause a situation that is limiting with respect to the MCPR. Please explain whether the LOSC has a potential to be CPR-limiting at PBAPS. If the LOSC is non-CPR limiting, explain what design features exist to provide protection from a LOSC. If the LOSC is a CPR-limiting event, please explain what affect the EPU could have on the severity of the event, and how the EPU safety analyses address the event.

<u>Accident Dose Branch (AADB)</u>
Reviewers: John Parillo and Jason White

AADB-RAI-2

In Section 2.1.5 of Attachment 1 to Exelon's letter dated May 24, 2013, the licensee stated that:

> The EPU Main Steam Line Break (MSLB) Exclusion Area Boundary (EAB) and Low Population Zone (LPZ) atmospheric dispersion factors are updated using a site-specific X/Q calculation. This differs from the CLB [current licensing basis] MSLB evaluation which used X/Q values calculated using guidance from RG [Regulatory Guide] 1.5.

Please provide a description of the calculation used for the updated MSLB X/Q values. Include a discussion of how it differs from the CLB MSLB evaluation, a justification for its use, and all inputs and assumptions used to make the calculation.