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

April 8, 2015

MEMORANDUM TO: Douglas A. Broaddus, Chief
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

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

SUBJECT: PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3, DRAFT REQUEST FOR ADDITIONAL INFORMATION (TAC NOS. MF4760 AND MF4761)

The attached draft request for additional information (RAI) was transmitted on April 7, 2015, to Mr. David Neff of Exelon Generation Company, LLC (Exelon, the licensee). An earlier revision of the RAI was transmitted to Mr. Neff on March 6, 2015. This information was transmitted to facilitate an upcoming conference call in order to clarify the licensee's amendment request for Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3, dated September 4, 2014, as supplemented by letters dated January 29, 2015, and February 6, 2015. The proposed amendment would revise the Technical Specifications (TSs) and Facility Operating Licenses to allow operation in the expanded Maximum Extended Load Line Limit Analysis Plus (MELLLA+) domain. The MELLLA+ expanded operating domain increases operating flexibility by allowing control of reactivity at maximum power by changing flow rather than by control rod insertion and withdrawal.

The draft RAI was sent to Exelon to ensure that the questions are understandable, the regulatory basis for the questions is clear, and to determine if the information was previously docketed. This memorandum and the attachment do not convey or represent an NRC staff position regarding the licensee's request.

Attachment 1 transmitted herewith contains sensitive unclassified information. When separated from Attachment 1, this document is decontrolled.

The NRC staff has determined that Attachment 1 contains proprietary information pursuant to Title 10 of the *Code of Federal Regulations* Section 2.390. Accordingly, the staff has prepared a redacted, publicly available, non-proprietary version (i.e., Attachment 2).

Docket Nos. 50-277 and 50-278

Attachments:
1. Draft Proprietary RAI (non-publicly available)
2. Draft Non-Proprietary RAI (publicly available)

DRAFT REQUEST FOR ADDITIONAL INFORMATION

REGARDING PROPOSED LICENSE AMENDMENT

MAXIMUM EXTENDED LOAD LINE LIMIT ANALYSIS PLUS

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 [[ ]].

Attachment 2

By letter dated September 4, 2014, as supplemented by letters dated January 29, 2015, and February 6, 2015 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML14247A503, ML15029A640, and ML15037A502, 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 revise the Technical Specifications (TSs) and Facility Operating Licenses to allow operation in the expanded Maximum Extended Load Line Limit Analysis Plus (MELLLA+) domain. The MELLLA+ expanded operating domain increases operating flexibility by allowing control of reactivity at maximum power by changing flow rather than by control rod insertion and withdrawal.

The Nuclear Regulatory Commission (NRC) staff has reviewed the information the licensee provided that supports the proposed amendment and would like to discuss the following issues to clarify the submittal.

Mechanical and Civil Engineering Branch (EMCB)
Reviewer: Chakrapani Basavaraju

EMCB-RAI-1

Section 3.3.3 of the MELLLA+ Safety Analysis Report (M+SAR[1]) indicates that the moisture carryover (MCO) values of the PBAPS steam dryer and separator under MELLLA+ conditions are bounded by the pre MELLLA+ conditions. Do the pre MELLLA+ conditions include Extended Power Uprate (EPU) conditions? Please clarify if the MCO values or steam quality for steam: (a) entering the steam separator; (b) exiting the steam separator; (c) entering the steam dryer; and (d) exiting the steam dryer, are affected by MELLLA+ core flow conditions. Are the values utilized in the EPU analysis bounding for combined EPU and MELLLA+ conditions for the replacement steam dryer (RSD)?

EMCB-RAI-2

Address if the boundary conditions used in the Acoustic Circuit Model (ACM) model for the RSD are affected by MELLLA+ flow. Is there any impact on the reactor water level and boundary conditions for the annular region between the RSD skirt and the separator stand pipes; and the annulus region between reactor pressure vessel (RPV) wall and the RSD skirt? Is there any impact on the RSD pressure loading used and on the RSD structural analysis?

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[1] A proprietary (i.e., non-publicly available) version of the M+SAR is contained in Attachment 4 to the application dated September 4, 2014. A non-proprietary (i.e., publicly available) version of the M+SAR is contained in Attachment 5 to the application.

EMCB-RAI-3

Address if the stresses in the RSD evaluated for EPU conditions are bounding for plant operation at EPU conditions combined with MELLLA+ conditions.

Reactor Systems Branch (SRXB)
Reviewers: George Thomas and Diego Saenz

SRXB-RAI-1

Appendix A to the M+SAR lists the limitations and conditions listed in Section 9.0 of the NRC staff safety evaluation (SE) for GE-Hitachi Nuclear Energy Americas LLC (GEH) licensing topical report (LTR) NEDC-33173P-A (ADAMS Accession No. ML121150469), referred to as the Methods LTR. Limitation and Condition 9.3 reads as follows:

> Plant-specific EPU and expanded operating domain applications will confirm that the core thermal power to core flow ratio will not exceed 50 MWt/Mlbm/hr at any statepoint in the allowed operating domain. For plants that exceed the power-to-flow value of 50 MWt/Mlbm/hr, the application will provide power distribution assessment to establish that neutronic methods axial and nodal power distribution uncertainties have not increased.

The power distribution root mean square (RMS) data provided to support the Methods SE (Method LTR Figure 3-4) ranged from [[ ]] and an extrapolation to 50 MWt/Mlbm/hr was allowed based on the safety limit minimum critical power ratio (SLMCPR) adders.

As discussed in Section 1.2.1 and 2.2.5 of the M+SAR, and shown in Table 2-3 of the M+SAR, the power-to-flow ratio at the low flow/high power statepoint "K" (55% of core flow, 78.8% of current licensed thermal power) is 55.23 MWt/Mlbm/hr, which exceeds the 50 MWt/Mlbm/hr value in Limitation and Condition 9.3. As such, a power distribution assessment is required. Provide a copy of a recent traversing incore probe (TIP) report and an evaluation of the power distribution uncertainties in PBAPS, showing historical power distribution uncertainties as function of burnup, to demonstrate that PBAPS is not an outlier plant (compared to other plants in the fleet).

SRXB-RAI-2

M+SAR Section 2.2.1, "Safety Limit Minimum Critical Power Ratio," states that "[t]he cycle-specific SLMCPR analysis will incorporate a +0.02 SLMCPR adder for MELLLA+ operation." Section 2.2.2 "Operating Limit Minimum Critical Power Ratio [OLMCPR]," states that "[w]ith the usage of TRACG-AOO instead of ODYN the +0.01 adder to the resulting OLMCPR as required by Methods LTR SER Limitation and Condition 9.19 is no longer applicable and will not be applied to the OLMCPR."

Provide a list of SLMCPR and OLMCPR adders in MELLLA+ with respect to pre-EPU conditions. Specify which adders are part of the EPU upgrade, and which are MELLLA+ specific.

SRXB-RAI-3

M+SAR Section 2.4.4 "M+LTR SER Limitation and Condition 12.5.b," states that feedwater (FW) temperature will be limited to be greater than 371.5 °F.

Further, M+ SAR Section 2.4.1 states:

> [[
>
>]]

a) Provide the variability in FW temperature for a typical 24-month cycle at full power conditions (i.e., min/max for the cycle).

b) Provide a justification for how [[ ]].

c) Expand on the reasoning why indefinite operation at reduced FW temperature is acceptable in the M+ domain, including what analysis was done to support this conclusion.

d) Provide plots of CPR versus time, and the time of DSS-CD scram for the TRACG calculations described in M+ SAR Section 2.4.1 [[ ]].

SRXB-RAI-4

The power-flow map (M+SAR Figure 1-1) shows Point F with 110% flow in the increased core flow (ICF) region. What is the maximum core flow that PBAPS can achieve? Is this a function of exposure (e.g., bottom-peaked shapes may result in reduced max achievable flow)? Is PBAPS susceptible to bi-stable flow in the recirculation loops? If so, what is the maximum (or range of) achievable recirculation flow used in normal operation to minimize bi-stable flow concerns?

SRXB-RAI-5

In reference to M+SAR Tables 2-4 and 2-5, provide the calculated MCPR margin for the equilibrium M+ cycle. Provide the OLMCPR and SLMCPR values (both two-loop operation (TLO) and single loop operation (SLO)) for the current operating cycle at PBAPS even if not designed for MELLLA+ operation.

SRXB-RAI-6

On M+SAR Figures 2-2 through 2-6, explain the difference between the lines labeled "PBAPS M+SAR" and "PBAPS M+SAR 100F." Do these refer to points D and J in Figure 1.1? What is the equivalent operating point for the other plants (A, B, C, D, E, and F) shown in Figures 2-2 through 2-6?

The text in SAR M+ Section 2.1.2 "Core Design and Fuel Thermal Monitoring Threshold." states:

> Figures 2-3 through 2-5 shows [sic] that exit voiding at PBAPS is higher than other plants. This is because of operating a high power density plant at lower CFs [core flows] through the entire cycle."

Are the other plants in these figures operated with the planned flow as a function of exposure, or at 100% flow?

SRXB-RAI-7

M+SAR Section 2.4.3 "Backup Stability Protection," describes that the detect and suppress solution - confirmation density (DSS-CD) LTR provides two options: (1) backup stability protection (BSP) manual regions and (2) BSP implemented with average power range monitor (APRM) flow-biased scram. This section of the PBAPS M+SAR appears to be a summary of the DSS-CD LTR, but it is not clear which of the two options will be implemented by PBAPS. Which option will PBAPS use for the first MELLLA+ cycle?

Have the BSP regions been evaluated for the PBAPS equilibrium cycle? Provide them if available. If not, where will they be documented?

SRXB-RAI-8

Provide additional plant design parameters relevant to the ATWS calculations in Section 9 of the M+SAR. Specifically: turbine bypass capacity, sources of high pressure injection and their operability issues (e.g., steam is lost after isolation), sources of low pressure injection and their operability issues (e.g., condensate storage tank (CST) pumps). Are FW pumps steam driven, or motor driven? Provide vessel component elevations in units comparable to the ones used for water level in the Section 9 figures (e.g., separators, FW spargers, nominal level, level setpoints for actuations, and top of active fuel (TAF)).

SRXB-RAI-9

Provide tables of the assumed sequence of events for the ODYN licensing calculation and the ATWS/instability calculation. Describe the sources of water used to control the reactor level. For the equipment used, describe automated actions and other assumptions about operability after the main steam isolation valve (MSIV) isolation occurs.

SRXB-RAI-10

Typically, critical operator actions for ATWS include: place the reactor switch in shutdown mode, initiate reduction of water level, initiate standby liquid control system (SLCS) injection, and terminate and prevent injection into the core. Provide a table with the critical operator actions in PBAPS, including two columns: (a) required timing by TS/procedure/training, and (b) assumed timing in the ATWS calculations. Note: report "NA" on the calculation column if the operator critical action has no impact on the calculation (e.g. place switch in shutdown mode). In addition, provide a discussion of the treatment of uncertainties for operator action timing.

SRXB-RAI-11

The neutron flux provided for the ATWS-instability turbine trip with full bypass (TTWBP) calculation is core-average, and the power oscillations [[

]] Is the oscillation out-of-phase (OOP)? Provide additional plots with hot channel powers at symmetric core locations showing the amplitude of the regional oscillations for the ATWS-instability calculation.

SRXB-RAI-12

a) Section 9.3.3 of the M+SAR specifies that [[
]] Is the TRACG quench model turned on for these calculations? Is it activated for the ATWS/instability transient?

b) The ATWS/instability calculation (M+SAR Figure 9-8) shows [[
]] What mechanism allows for rewet if the quench model is turned off?

c) Provide plots similar to M+SAR Figure 9-8 that shows PCT superimposed with the calculated Tmin value.

SRXB-RAI-13

What methods are used for PBAPS fluence calculations for the Pressure and Temperature Limits Report (PTLR) results? How is the uncertainty in the fluence calculation impacted by MELLLA+? Does the uncertainty stay below 20%?

SRXB-RAI-14

Question Deleted.

SRXB-RAI-15

M+SAR Section 2.4.1, "DSS-CD Setpoints," page 2-13, states:

[[

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Provide the TRACG transient results to demonstrate that [[
]] In the results, mark the time that DSS-CD detects the oscillations and would have scrammed if active for this calculation.

SRXB-RAI-16

With regard to M+SAR Section 3.1.2, "Overpressure Relief Capacity," what is the peak calculated pressure for the overpressure analyses? Specify the most limiting overpressure event.

SRXB-RAI-17

There are three outliers that are visually apparent in M+SAR Figure 2-17 at Integrated Bundle Power (PB) vs Bundle Average In-Channel Void Fraction (VFC) of about 0.5 and 0.41, respectively. Provide a discussion on these and any other outliers in Figure 2-17.

PRA and Human Performance Branch (APHB)
Reviewers: Molly Keefe and Brian Green

APHB-RAI-13

Attachment 1 to the licensee's submittal dated February 6, 2015, described future actions Exelon plans to take with respect to time-critical operator actions associated with the MELLLA+ analysis. Since the licensee has not yet validated that these time-critical operator actions can be completed consistent with the MELLLA+ analysis, the NRC staff proposes that the licensee add a license condition to control these validation activities. Please confirm the acceptability of the following proposed license condition, or propose an alternative:

(17) Maximum Extended Load Line Limit Analysis Plus (MELLLA+) Operator Training

Prior to operation in the MELLLA+ operating domain, the licensee shall:

a) Complete operator training on time-critical actions supporting the MELLLA+ analysis.

b) Validate the ability to complete the time-critical actions consistent with the assumptions in the MELLLA+ analysis.

c) Provide the results of the validation activities to the NRC as a report in accordance with 10 CFR 50.4. As a minimum, the report shall contain the following: (a) a listing of the time-critical response times assumed in the MELLLA+ analysis; (b) the average times recorded for completion of the associated actions for all operating crews during operator training; and (c) any problems/discrepancies identified during the validation activities and how the problems/discrepancies were resolved. The report shall be submitted to the NRC within 90 days following completion of the validation activities.

The NRC staff has determined that Attachment 1 contains proprietary information pursuant to Title 10 of the *Code of Federal Regulations* Section 2.390. Accordingly, the staff has prepared a redacted, publicly available, non-proprietary version (i.e., Attachment 2).

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2. Draft Non-Proprietary RAI (publicly available)

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ADAMS Accession Nos.: Package: ML15098A047
Memo and Attachment 2 (publicly available): ML15098A039
Attachment 1 (non-publicly available): ML15098A044

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