



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

September 30, 2011

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, UNIT 3 - ISSUANCE OF  
AMENDMENT RE: SAFETY LIMIT MINIMUM CRITICAL POWER RATIO VALUE  
CHANGE (TAC NO. ME6391)

Dear Mr. Pacilio:

The Nuclear Regulatory Commission (NRC) has issued the enclosed Amendment No. 284 to Renewed Facility Operating License No. DPR-56 for the Peach Bottom Atomic Power Station (PBAPS), Unit 3. The amendment consists of changes to the Technical Specifications (TSs) in response to your application dated June 8, 2011, as supplemented by letters dated August 19, 2011, and September 9, 2011.<sup>1</sup>

The amendment issued with this letter modifies TS 2.1.1, "Reactor Core SLs [safety limits]" to reflect revised Safety Limit Minimum Critical Power Ratio values for Operating Cycle 19.

All work is complete on TAC No. ME6391. Accordingly, this TAC No. will be closed. A copy of our Safety Evaluation is enclosed and a Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

A handwritten signature in black ink, appearing to read "John D. Hughey", with a long horizontal flourish extending to the right.

John D. Hughey, Project Manager  
Plant Licensing Branch I-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-278

Enclosures:

1. Amendment No. 284 to Renewed DPR-56
2. Safety Evaluation

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<sup>1</sup> Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML111600180, ML112340236 and ML112550469, respectively.



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EXELON GENERATION COMPANY, LLC

PSEG NUCLEAR LLC

DOCKET NO. 50-278

PEACH BOTTOM ATOMIC POWER STATION, UNIT 3

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 284  
License No. DPR-56

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Exelon Generation Company, LLC (Exelon Generation Company), and PSEG Nuclear LLC (the licensees), dated June 8, 2011, as supplemented by letters dated August 19, 2011, and September 9, 2011, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;
  - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
  - C. There is reasonable assurance: (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;
  - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
  - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.
2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. DPR-56 is hereby amended to read as follows:

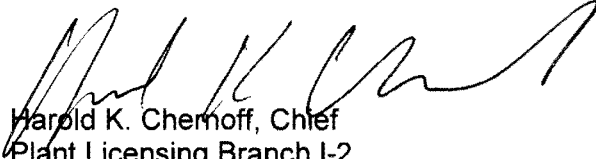
(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 284 , are hereby incorporated in the license. Exelon Generation Company shall operate the facility in accordance with the Technical Specifications.

3. Implementation Requirements:

This license amendment is effective as of the date of its issuance, and shall be implemented within 30 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



Harold K. Chernoff, Chief  
Plant Licensing Branch I-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Attachment: Changes to the Renewed  
Facility Operating License  
No. DPR-56 and  
Technical Specifications

Date of Issuance: September 30, 2011

ATTACHMENT TO LICENSE AMENDMENT NO. 284

RENEWED FACILITY OPERATING LICENSE NO. DPR-56

DOCKET NO. 50-278

Replace the following page of the Renewed Facility Operating License No. DPR-56 with the attached revised page. The revised page is identified by amendment number and contains marginal lines indicating the areas of change.

Remove

Insert

Page 3

Page 3

Replace the following page of Appendix A, Technical Specifications, with the attached revised page. The revised page is identified by amendment number and contains marginal lines indicating the area of change.

Remove

Insert

2.0-1

2.0-1

- (5) Exelon Generation Company, pursuant to the Act and 10 CFR Parts 30 and 70, to possess, but not to separate, such byproduct and special nuclear material as may be produced by operation of the facility, and such Class B and Class C low-level radioactive waste as may be produced by the operation of Limerick Generating Station, Units 1 and 2.

C. This renewed license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations in 10 CFR Chapter I: Part 20, Section 30.34 of Part 30, Section 40.41 of Part 40, Section 50.54 of Part 50, and Section 70.32 of Part 70; all applicable provisions of the Act and the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified below:

- (1) Maximum Power Level

Exelon Generation Company is authorized to operate the Peach Bottom Atomic Power Station, Unit No. 3, at steady state reactor core power levels not in excess of 3514 megawatts thermal.

- (2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No.284 , are hereby incorporated in the license. Exelon Generation Company shall operate the facility in accordance with the Technical Specifications.<sup>1</sup>

- (3) Physical Protection

Exelon Generation Company shall fully implement and maintain in effect all provisions of the Commission-approved physical security, training and qualification, and safeguards contingency plans including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10 CFR 73.55 (51 FR 27817 and 27822), and the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The combined set of plans<sup>2</sup>, submitted by letter dated May 17, 2006, is entitled: "Peach Bottom Atomic Power Station Security Plan, Training and Qualification Plan, Safeguards Contingency Plan, and Independent Spent Fuel Storage Installation Security Program, Revision 3." The set contains Safeguards Information protected under 10 CFR 73.21.

Exelon Generation Company shall fully implement and maintain in effect all provisions of the Commission-approved cyber security plan (CSP), including changes made pursuant to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The Exelon Generation Company CSP was approved by License Amendment No. 283.

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<sup>1</sup>Licensed power level was revised by Amendment No. 250, dated November 22, 2002, and will be implemented following the 14<sup>th</sup> refueling outage currently scheduled for Fall 2003.

<sup>2</sup>The training and Qualification Plan and Safeguards Contingency Plan and Appendices to the Security Plan.

## 2.0 SAFETY LIMITS (SLs)

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### 2.1 SLs

#### 2.1.1 Reactor Core SLs

2.1.1.1 With the reactor steam dome pressure < 785 psig or core flow < 10% rated core flow:

THERMAL POWER shall be  $\leq$  25% RTP.

2.1.1.2 With the reactor steam dome pressure  $\geq$  785 psig and core flow  $\geq$  10% rated core flow:

MCPR shall be  $\geq$  1.09 for two recirculation loop operation or  $\geq$  1.12 for single recirculation loop operation.

2.1.1.3 Reactor vessel water level shall be greater than the top of active irradiated fuel.

#### 2.1.2 Reactor Coolant System Pressure SL

Reactor steam dome pressure shall be  $\leq$  1325 psig.

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### 2.2 SL Violations

With any SL violation, the following actions shall be completed within 2 hours:

2.2.1 Restore compliance with all SLs; and

2.2.2 Insert all insertable control rods.

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(continued)



UNITED STATES  
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 284 TO RENEWED FACILITY

OPERATING LICENSE NO. DPR-56

EXELON GENERATION COMPANY, LLC

PSEG NUCLEAR, LLC

PEACH BOTTOM ATOMIC POWER STATION, UNIT 3

DOCKET NO. 50-278

1.0 INTRODUCTION

By letter to the Nuclear Regulatory Commission (NRC) dated June 8, 2011,<sup>1</sup> Exelon Generation Company, LLC, (Exelon or the licensee) submitted a License Amendment Request (LAR) for Peach Bottom Atomic Power Station (PBAPS), Unit 3. The submittal seeks to revise Technical Specification (TS) 2.1.1, "Reactor Core SLs [safety limits]" to reflect revised Safety Limit Minimum Critical Power Ratio (SLMCPR) values for Operating Cycle 19. The PBAPS Unit 3, Operating Cycle 19 core has 764 General Electric (GE) fuel assemblies, of which there are 268 fresh Global Nuclear Fuels (GNF)<sup>2</sup> bundles, 274 once burned GE14 bundles, and 222 twice burned GE14 bundles. The SLMCPR analysis establishes SLMCPR values that will ensure that during normal operation and during abnormal operational transients, at least 99.9% of all fuel rods in the core do not experience transition boiling if the limit is not violated. The SLMCPRs are calculated to include cycle-specific parameters.

Exelon provided supplemental information by letters dated August 19, 2011, and September 9, 2011.<sup>2</sup> The supplements clarified the application, did not expand the scope of the application as originally noticed, and did not change the NRC staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on August 22, 2011 (76 FR 52357).

The NRC staff has completed its review and finds that the requested TS modifications are acceptable, as discussed in this safety evaluation.

2.0 REGULATORY EVALUATION

The purpose of the SLMCPR is to ensure that specified acceptable fuel design limits (SAFDLs) are not exceeded during steady state operation and analyzed transients. The fuel cladding is one of the physical barriers that separate radioactive material from the environment. The

<sup>1</sup> Agencywide Documents Access and Management System (ADAMS) Accession No. ML111600180.

<sup>2</sup> ADAMS Accession Nos. ML112340236 and ML112550469.

integrity of this cladding barrier is related to its relative freedom from perforations or cracking. Fuel cladding perforations can result from thermal stresses, which can occur from reactor operation significantly above design conditions. Since the parameters that result in fuel damage are not directly observable during reactor operation, the thermal and hydraulic conditions that result in the onset of transition boiling have been used to mark the beginning of the region in which fuel cladding damage could occur.

Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50 Section 36, "Technical specifications," paragraph (c)(1), requires that power reactor facility TS include safety limits for process variables that protect the integrity of certain physical barriers that guard against the uncontrolled release of radioactivity. The fuel cladding integrity SLMCPR is established to assure that at least 99.9% of the fuel rods in the core do not experience boiling transition during normal operation and abnormal operating transients. Thus, the SLMCPR values are required to be contained in the TS.

PBAPS Unit 3 was designed, built, and began operation prior to the codification of the 10 CFR Appendix A, General Design Criteria (GDC), and the issuance of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR [light water reactor] Edition." Thus, the GDC are not part of the original design basis of the plant. Appendix H of the Updated Final Safety Analysis Report for PBAPS Unit 3 contains an evaluation of the design basis of the plant as measured against the GDC for Nuclear Power Plant Construction Permits that were proposed to be added to 10 CFR Part 50 as Appendix A in July 1967. The licensee concluded that PBAPS Unit 3 conformed to the intent of the AEC (NRC) proposed GDC.

The NRC staff used 10 CFR Part 50, Appendix A, Criterion 10 (GDC-10), "Reactor Design," and NUREG-0800 as evaluation criteria for the proposed LAR. GDC-10 states, that the reactor core and associated coolant, control, and protection systems shall be designed with appropriate margin to assure that SAFDLs are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences. NUREG-0800 provides guidance on the acceptability of the reactivity control systems, the reactor core, and fuel system design. Specifically, Section 4.2, Revision 3, "Fuel System Design," specifies all fuel damage criteria for evaluation of whether fuel designs meet the SAFDLs. Section 4.4, Revision 2, "Thermal Hydraulic Design," provides guidance on the review of thermal-hydraulic design in conforming to GDC-10 and the fuel design criteria established in Section 4.2, Revision 3.

### 3.0 TECHNICAL EVALUATION

#### 3.1 Proposed TS Changes

The submittal seeks to revise TS 2.1.1, "Reactor Core SLs [safety limits]" to reflect revised SLMCPR values for Operating Cycle 19. The SLMCPR values in TS 2.1.1.2 are proposed to change from  $\geq 1.07$  to  $\geq 1.09$  for two recirculation loop operations, and to change from  $\geq 1.09$  to  $\geq 1.12$  for single recirculation loop operation. These SLMCPR values are for the reactor steam dome pressure less than 785 psig or core flow less than 10 percent of rated core flow.



### 3.2 NRC Staff Evaluation

The licensee described the methodology to calculate the new SLMCPR values for the TS in its submittal and supplements. The Cycle 19 SLMCPR analysis was performed by Global Nuclear Fuel (GNF) using plant- and cycle-specific fuel and core parameters, and NRC approved methodologies, including the following:

- NEDE-24011P-A, "General Electric Standard Application for Reactor Fuel (GESTAR II)," Revision 18, April 2011
- NEDC-32505P-A, "R-Factor Calculation Method for GE11, GE12 and GE13 Fuel," Revision 1, July 1999
- NEDC-32601P-A, "Methodology and Uncertainties for Safety Limit MCPR Evaluations," August 1999
- NEDC-32694P-A, "Power Distribution Uncertainties for Safety Limit MCPR Evaluation," August 1999
- NEDO-10958P-A, "General Electric BWR [Boiling-Water Reactor] Thermal Analysis Basis (GETAB): Data, Correlation, and Design Application," January 1977

The PBAPS Unit 3, Operating Cycle 19 reactor core design includes 268 fresh GNF2 fuel assemblies. The licensee addressed the applicability of the above-approved methodologies to the associated SLMCPR calculation since the data bases for the GNF2 fuel were not included in those approved methodologies. The NRC staff reviewed the licensee's justification for the applicability of the above-approved methodologies to PBAPS Unit 2, Operating Cycle 19 including the NRC staff's audit report dated September 25, 2008, "Audit Report for Global Nuclear Fuels GNF2 Advanced Fuel Assembly Design GESTAR II Compliance Audit."<sup>3</sup> The NRC staff's audit report was based on the GESTAR II compliance documentation for GNF2 fuel. The audit report concluded that the licensee's justification is acceptable because GNF2 fuel meets the requirements as specified in limitations and conditions of the approved methodologies.

The licensee addressed the final core loading pattern selection for the PBAPS Unit 3, Operating Cycle 19 operation with respect to the combination of the input parameters, such as cycle energy requirements, thermal limit margins, reactivity margins, discharge exposure limitations and other limits, as well as desired control rod patterns, and channel distortion. The SLMCPR calculation process was addressed with respect to the uncertainties associated with R-Factor, and core flow rate and random effective traversing in-core probe (TIP) reading. The licensee also addressed the mechanisms to push the SLMCPR increase into the higher range of expectations.

The NRC staff reviewed the information presented in the submittal and supplemental information and concluded that the licensee provided satisfactory data and methodology descriptions. The NRC staff determined that the proposed revisions to the TS SLMCPR values for PBAPS Unit 3, Operating Cycle 19 operation from  $\geq 1.07$  to  $\geq 1.09$  for two recirculation loop

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<sup>3</sup> ADAMS Accession No. ML081630579

operation and from  $\geq 1.09$  to  $\geq 1.12$  for single recirculation loop operation are acceptable for the following reasons:

- (1) Approved methodologies are used with acceptable justification for the method deviation and adjusted uncertainties relating to R-Factor and TIP reading.
- (2) The GNF2 data contained in Figure 5 of the submittal and supplemental information is acceptable to the NRC staff.
- (3) Qualitative and quantitative descriptions of the final core loading pattern and critical power analysis are provided and considered acceptable to the NRC staff.
- (4) Mechanisms to push the SLMCPR increase into the higher range of expectations are identified along with the result that the GNF2 fuel would dominate the SLMCPR calculation.

The NRC staff also reviewed the justification for the SLMCPR value of  $\geq 1.09$  for two recirculation loop operation and  $\geq 1.12$  for single recirculation loop operation using the approach stated in Revision 18 of the GESTAR-II methodology. Based on our review of the submittal, and the supplemental information, the NRC staff has concluded that the SLMCPR analysis for PBAPS Unit 3, Operating Cycle 19 operation using the plant- and cycle-specific calculation in conjunction with the approved method is acceptable. The Cycle 19 SLMCPR will ensure that 99.9% of the fuel rods in the core will not experience boiling transition which also conforms with GDC-10 of Appendix A to 10 CFR Part 50 regarding acceptable fuel design limits. The NRC staff has concluded that the justification for analyzing and determining the SLMCPR value of  $\geq 1.09$  for two recirculation loop operation and  $\geq 1.12$  for single recirculation loop operation for PBAPS Unit 3, Operating Cycle 19 is acceptable since approved methodologies were used in conjunction with the assumption of a higher R-Factor uncertainty, performance of a bounding calculation at rated core power and minimum core flow was completed, and analysis on power shape for Cycle 19 operation was performed and resulted in no fuel axial power shape penalty for the limiting bundles.

Based on the review above, the NRC staff finds that the above described TS changes involving the SLMCPR values in TS 2.1.1.2 for both two loop and single loop operation are acceptable for PBAPS Unit 3, Operating Cycle 19 operation because the changes were analyzed based on NRC-approved methods using PBAPS Unit 3, cycle-specific inputs for the fuel bundles in the core for Cycle 19 operation.

#### 4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Pennsylvania State official was notified of the proposed issuance of the amendments. The State official had no comments.

#### 5.0 FINAL NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, on August 22, 2011 (76 FR 52357). Pursuant to 10 CFR 50.92, the Commission may issue the license amendment before the expiration of the 60- day period provided that a final determination is made that the amendment involves no

significant hazards consideration. This amendment is being issued prior to the expiration of the 60-day period. Therefore, a final finding of no significant hazards consideration follows.

The Commission has made a final determination that the amendment request involves no significant hazards consideration. Under the Commission's regulations in 10 CFR 50.92, this means that operation of the facility in accordance with the proposed amendment does not (1) involve a significant increase in the probability or consequences of an accident previously evaluated; or (2) create the possibility of a new or different kind of accident from any accident previously evaluated; or (3) involve a significant reduction in a margin of safety. As required by 10 CFR 50.91(a), the licensee has provided its analysis of the issue of no significant hazards consideration which is presented below.

1. Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No.

The derivation of the cycle specific Safety Limit Minimum Critical Power Ratios (SLMCPRs) for incorporation into the Technical Specifications (TS), and their use to determine cycle specific thermal limits, has been performed using the methodology discussed in NEDE-2401 1-P-A, "General Electric Standard Application for Reactor Fuel," Revision 18.

The basis of the SLMCPR calculation is to ensure that during normal operation and during abnormal operational transients, at least 99.9% of all fuel rods in the core do not experience transition boiling if the limit is not violated. The new SLMCPRs preserve the existing margin to transition boiling.

The MCPR safety limit is reevaluated for each reload using NRC-approved methodologies. The analyses for Peach Bottom Atomic Power Station (PBAPS), Unit 3, Operating Cycle 19 have concluded that a two recirculation loop MCPR safety limit of  $\geq 1.09$ , based on the application of Global Nuclear Fuel's NRC-approved MCPR safety limit methodology, will ensure that this acceptance criterion is met. For single recirculation loop operation, a MCPR safety limit of  $\geq 1.12$  also ensures that this acceptance criterion is met. The MCPR operating limits are presented and controlled in accordance with the PBAPS, Unit 3 Core Operating Limits Report (COLR).

The requested TS changes do not involve any plant modifications or operational changes that could affect system reliability or performance or that could affect the probability of operator error. The requested changes do not affect any postulated accident precursors, do not affect any accident mitigating systems, and do not introduce any new accident initiation mechanisms.

Therefore, the proposed TS changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No.

The SLMCPR is a TS numerical value, calculated to ensure that during normal operation and during abnormal operational transients, at least 99.9% of all fuel rods in the core do not experience transition boiling if the limit is not violated. The new SLMCPRs are calculated using NRC-approved methodology discussed in NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel," Revision 18. The proposed changes do not involve any new modes of operation, any changes to setpoints, or any plant modifications. The proposed revised MCPR safety limits have been shown to be acceptable for Cycle 19 operation. The core operating limits will continue to be developed using NRC-approved methods. The proposed MCPR safety limits or methods for establishing the core operating limits do not result in the creation of any new precursors to an accident.

Therefore, this change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed amendment involve a significant reduction in a margin of safety?

Response: No.

There is no significant reduction in the margin of safety previously approved by the NRC as a result of the proposed change to the SLMCPRs. The new SLMCPRs are calculated using methodology discussed in NEDE-24011-P-A, "General Electric Standard Application for Reactor Fuel," Revision 18. The SLMCPRs ensure that during normal operation and during abnormal operational transients, at least 99.9% of all fuel rods in the core do not experience transition boiling if the limit is not violated, thereby preserving the fuel cladding integrity.

Therefore, the proposed TS changes do not involve a significant reduction in the margin of safety previously approved by the NRC.

The NRC staff has reviewed the licensee's analysis and based on this review, determined that the three standards of 10 CFR 50.92 are satisfied. Therefore, the NRC staff has determined that the amendments involve no significant hazards consideration.

## 6.0 ENVIRONMENTAL CONSIDERATION

The NRC staff has determined that the amendments change requirements with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant

increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The changes discussed in this safety evaluation meet the eligibility criteria for the categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

## 7.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: Tai Huang

Date: September 30, 2011

September 30, 2011

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, UNIT 3 - ISSUANCE OF  
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The amendment issued with this letter modifies TS 2.1.1, "Reactor Core SLs [safety limits]"  
to reflect revised Safety Limit Minimum Critical Power Ratio values for Operating Cycle 19.

All work is complete on TAC No. ME6391. Accordingly, this TAC No. will be closed. A copy of  
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Sincerely,  
*/ra/*  
John D. Hughey, Project Manager  
Plant Licensing Branch I-2  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-278

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