



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

February 26, 2019

Mr. Bryan C. Hanson
Senior Vice President
Exelon Generation Company, LLC
President and Chief Nuclear Officer
Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3 – ISSUANCE
OF AMENDMENT NOS. 324 AND 327 RE: EXPANDED ACTIONS FOR
LEADING EDGE FLOW METER CONDITIONS (EPID L-2018-LLA-0230)

Dear Mr. Hanson:

The U.S. Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendments Nos. 324 and 327 to Renewed Facility Operating License Nos. DPR-44 and DPR-56 for Peach Bottom Atomic Power Station, Units 2 and 3 (Peach Bottom), respectively. These amendments authorize changes to the Technical Requirements Manual in response to your application dated August 27, 2018.

These amendments authorize revisions to Section 3.20 of the Technical Requirements Manual to establish three separate intermediate power levels for the Leading Edge Flow Meter system when the mass flow input to the core thermal power calculation is from one, two, or three feedwater lines in Check mode with none in Fail mode, and a fourth intermediate power level when not more than one Leading Edge Flow Meter is in Fail mode and flow measurement is being provided by the associated feedwater flow nozzle.

Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

A handwritten signature in black ink, reading "Jennifer C. Tobin".

Jennifer C. Tobin, Project Manager
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-277 and 50-278

Enclosures:

1. Amendment No. 324 to Renewed DPR-44
2. Amendment No. 327 to Renewed DPR-56
3. Safety Evaluation

cc: Listserv



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EXELON GENERATION COMPANY, LLC

PSEG NUCLEAR LLC

DOCKET NO. 50-277

PEACH BOTTOM ATOMIC POWER STATION, UNIT 2

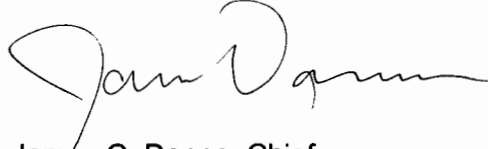
AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 324
Renewed License No. DPR-44

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Exelon Generation Company, LLC and PSEG Nuclear LLC (the licensees), dated August 27, 2018, 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, by Amendment No. 324, Facility Operating License No. DPR-56 is hereby amended to authorize revision to the Peach Bottom Atomic Power Station Technical Requirements Manual, as set forth in the licensee's application dated August 27, 2018, and evaluated in the NRC staff's evaluation enclosed with this amendment.
3. This license amendment is effective as of its date of issuance and shall be implemented immediately.

FOR THE NUCLEAR REGULATORY COMMISSION

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James G. Danna, Chief
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Date of Issuance: February 26, 2019



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

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. 327
Renewed License No. DPR-56

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Exelon Generation Company, LLC and PSEG Nuclear LLC (the licensees), dated August 27, 2018, 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, by Amendment No. 327, Facility Operating License No. DPR-56 is hereby amended to authorize revision to the Peach Bottom Atomic Power Station Technical Requirements Manual, as set forth in the licensee's application dated August 27, 2018, and evaluated in the NRC staff's evaluation enclosed with this amendment.
3. This license amendment is effective as of its date of issuance and shall be implemented immediately.

FOR THE NUCLEAR REGULATORY COMMISSION

A handwritten signature in black ink, appearing to read "James Danna", written in a cursive style.

James G. Danna, Chief
Plant Licensing Branch I
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Date of Issuance: February 26, 2019



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NOS. 324 AND 327

TO RENEWED FACILITY OPERATING LICENSE NOS. DPR-44 AND DPR-56

EXELON GENERATION COMPANY, LLC

PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3

DOCKET NOS. 50-277 AND 50-278

1.0 INTRODUCTION

By letter dated August 27, 2018 (Reference 1), Exelon Generation Company, LLC (Exelon, the licensee) submitted a license amendment request (LAR) to expand the number of intermediate power levels for the Leading Edge Flow Meter (LEFM) system from one to four. The license amendments would revise Section 3.20 of the Peach Bottom Atomic Power Station (Peach Bottom), Units 2 and 3, Technical Requirements Manual (TRM). The revisions would establish three separate intermediate power levels for the LEFM system when the mass flow input to the core thermal power calculation is from one, two, or three feedwater (FW) lines in Check mode with none in Fail mode, and a fourth intermediate power level when not more than one LEFM is in Fail mode and flow measurement is being provided by the associated FW flow nozzle.

In February 2017, Exelon submitted a measurement uncertainty recapture (MUR) LAR (Reference 3) to revise the Facility Operating Licenses and Technical Specifications (TSs) for Peach Bottom, Units 2 and 3, based on the increased accuracy of the LEFM ultrasonic FW flow measurement instrumentation relative to the FW flow nozzle differential pressure measurement when used to calculate reactor core thermal power (CTP). The U.S. Nuclear Regulatory Commission (NRC or the Commission) approved this LAR in November 2017. Issuance of the MUR license amendments resulted in an increase of the rated thermal power at Peach Bottom from 3,951 megawatts thermal (MWt) to 4,016 MWt. However, the MUR license amendments require that if an LEFM changes modes or is otherwise taken out of service, the licensee must switch the FW flow input for the CTP calculation from the affected LEFM(s) to the associated FW line's nozzle within 2 hours. If any LEFM is not restored by the end of the 72-hour compensatory measures completion time required by the TRM, power must be reduced to the pre-MUR licensed level of $\leq 3,951$ MWt. The proposed changes in this LAR would allow operation at intermediate power levels commensurate with the uncertainties in the measurement of core thermal power and reduce the magnitude of the required reactivity maneuver and plant power level change.

2.0 REGULATORY EVALUATION

General Design Criteria

The construction permit for Peach Bottom was issued by the Atomic Energy Commission (AEC) on January 31, 1968. As discussed in Appendix H to the Peach Bottom Updated Final Safety Analysis Report (UFSAR), during the construction/licensing process, Peach Bottom was evaluated against the then current AEC draft of the 27 General Design Criteria (GDC) issued in November 1965. On July 11, 1967, the AEC published, for public comment in the *Federal Register* (32 FR 10213), a revised and expanded set of 70 draft GDC (the draft GDC). Appendix H of the Peach Bottom UFSAR contains an evaluation of the design basis of Peach Bottom against the draft GDC. The licensee concluded that Peach Bottom conforms to the intent of the draft GDC.

On February 20, 1971, the AEC published in the *Federal Register* (36 FR 3255) a final rule that added Appendix A to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "General Design Criteria for Nuclear Power Plants" (the final GDC). Differences between the draft GDC and final GDC included a consolidation from 70 to 64 criteria. As discussed in the NRC Staff Requirements Memorandum, SECY-92-223, "Resolution of Deviations Identified During the Systematic Evaluation Program," dated September 18, 1992 (Reference 2), the Commission decided not to apply the final GDC to plants with construction permits issued prior to May 21, 1971. At the time of the promulgation of Appendix A to 10 CFR Part 50, the Commission stressed that the final GDC were not new requirements and were promulgated to more clearly articulate the licensing requirements and practice in effect at that time. Each plant licensed before the final GDC were formally adopted was evaluated on a plant-specific basis determined to be safe and licensed by the Commission.

The licensee for Peach Bottom has made changes to the facility over the life of the plant that have invoked the final GDC. The extent to which the final GDC have been invoked can be found in specific sections of the UFSAR and in other plant-specific design and licensing basis documentation.

The NRC staff identified the following GDC as being applicable to this LAR:

Draft GDC 1, "Quality Standards (Category A)," requires, in part, that those systems and components that are essential to the prevention of accidents, which could affect the public health and safety or mitigate their consequences be designed, fabricated, and erected to quality standards commensurate with the importance of the safety function to be performed.

Draft GDC 12, "Instrumentation and Control Systems (Category B)," requires that instrumentation and controls be provided, as required, to monitor and maintain variables within prescribed operating ranges.

Regulatory Requirements and Guidance Documents

The regulation in 10 CFR 50.59(c)(2)(viii) requires a licensee to obtain a license amendment pursuant to 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," prior to implementing a proposed change, if the change would "[r]esult in a departure from a method of evaluation described in the FSAR [Final Safety Analysis Report] (as updated) used in establishing the design bases or in the safety analysis."

The LAR proposed revisions to Section 3.20 of the TRM. Nuclear Energy Institute (NEI) guidance document NEI 98-03, Revision 1, "Guidelines for Updating Final Safety Analysis Reports" (Reference 15), page 7 of Appendix A, lists the following methods of controlling the TRM:

The TRM or other licensee controlled document is explicitly "incorporated by reference" into the UFSAR. Under this approach, the referenced document is subject to the change control requirements of 10 CFR 50.59 and the update/reporting requirements of 10 CFR 50.71(e), e.g., periodic submittal of change pages, etc.

The TRM or other licensee controlled document is treated in a manner consistent with procedures fully or partially described in the UFSAR. Under this approach, the referenced document is maintained on-site in accordance with licensee administrative processes, and changes are evaluated using 10 CFR 50.59.

Regulatory Guide 1.181, "Content of the Updated Final Safety Analysis Report in Accordance with 10 CFR 50.71e" (Reference 16), states that Revision 1 of NEI 98-03 provides methods that are acceptable to the NRC staff for complying with the provisions of 10 CFR 50.71(e).

The TRM is described in Section 13.6.8 of the Peach Bottom UFSAR. This section of the UFSAR states, in part, that in accordance with NEI 98-03, Revision 1, the TRM is treated in a manner consistent with procedures fully or partially described in the UFSAR. As such, changes to the TRM are controlled under the provisions of 10 CFR 50.59.

Appendix K, "ECCS Evaluation Models," to 10 CFR Part 50, requires that emergency core cooling system (ECCS) evaluation models assume that the reactor has been operating continuously at a power level at least 1.02 times the licensed power level to allow for instrumentation error. A change to this paragraph, which became effective when the NRC published a final rule in the *Federal Register* on July 1, 2000 (65 FR 34913), allows a lower assumed power level, provided the proposed value has been demonstrated to account for uncertainties due to power level instrumentation error.

Regulatory Guide 1.105, Revision 3, "Setpoints for Safety-Related Instrumentation," dated December 31, 1999 (Reference 5), provides a method acceptable to the NRC staff for complying with NRC regulations for ensuring that setpoints for safety-related instrumentation are initially within and remain within the technical specification limits.

Regulatory Issue Summary (RIS) 2002-03, "Guidance on the Content of Measurement Uncertainty Recapture Power Uprate Applications," dated January 31, 2002 (Reference 6), provides criteria for the content of an LAR that requests an MUR power uprate.

The LEFM system flow measurement method is described in Caldon Topical Report ER-80P (Reference 10, non-public), and its supplement ER-157P (Reference 11, non-public). The NRC staff's safety evaluations (SEs) approving these reports (Reference 12 and Reference 7, respectively) established nine criteria for use of these topical reports in plant-specific LARs and is consistent with RIS 2002-03.

The NRC staff reviews the human performance aspects of LARs utilizing the review guidance in Chapter 18 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition – Human Factors Engineering" (Reference 8), and

NUREG-1764, Revision 1, "Guidance for the Review of Changes to Human Actions" (Reference 9). NUREG-1764 provides guidance for determining the appropriate level of human factors engineering review the staff should perform based on the risk-importance of the human actions. A Level III review is the least stringent of the graded reviews described in the guidance of NUREG-1764. A Level III review is a minimal review intended to verify the appropriateness of the low risk categorization and that current regulations continue to be met. The risk assessment used for scoping the human factors review is not intended to be equivalent to the risk assessment performed using NRC-accepted methods of probabilistic risk analysis or human reliability analysis and may not align with the licensee's risk assessment or that of other portions of the NRC staff's review.

3.0 TECHNICAL EVALUATION

3.1 System Description

The Peach Bottom LEFM system consists of three LEFMs, one on each of the three FW lines. Each LEFM contains two independent subsystems or planes with each plane containing four acoustic paths. The LEFM system has two operating modes (CheckPlus and Check) and an inoperable mode (Fail). In the CheckPlus mode (also described in the LAR as the Normal mode), both planes of transducers are in service. If an LEFM is subjected to a failure involving a transducer in one plane of operation, that LEFM reverts to the Check mode (also described in the LAR as the Maintenance mode). The flow data from an LEFM with a single functioning plane (Check mode) has a greater associated measurement uncertainty than that of an LEFM with both planes functioning, but less associated measurement uncertainty than that of a FW flow nozzle. The Peach Bottom TRM Section 3.20, "Leading Edge Flow Meter (LEFM) System," governs the maximum allowed power when any of the LEFMs are in modes other than CheckPlus. Section 3.20 was added to the TRM as part of the MUR license amendment.

The LEFM status is determined and reported by the LEFM system computer based on the number of functional planes in the LEFM and the data quality. If one or more LEFMs goes into the Check mode with none in Fail mode, operators must switch flow input to the core thermal power (CTP) calculation from the LEFM(s) that are not in CheckPlus mode to the associated calibrated FW flow nozzle within 2 hours. By the end of the 72-hour compensatory measures completion time (required in TRM Section 3.20), either all LEFMs must be restored to the CheckPlus mode with all flow input to the CTP calculation from the LEFMs, or the maximum allowable power level must be reduced to $\leq 4,010$ MWt.

If one or more LEFM FW flow nozzle(s) reverts to the Fail mode or is not providing flow input to the CTP calculation, flow measurement from that FW line must be transferred to its calibrated FW flow nozzle within 2 hours. A FW flow nozzle is considered calibrated when a venturi correction factor (VCF) is applied to the FW flow nozzle measurement in accordance with Peach Bottom procedures. The VCF is the ratio of the flow measurement from the LEFM in CheckPlus mode to that of the associated FW flow nozzle. Under the current requirements, power must then be reduced to the pre-MUR level of $\leq 3,951$ MWt before the end of the 72-hour TRM-required compensatory measures completion time if all of the LEFMs have not been restored to either the CheckPlus or Check mode.

The LEFM acoustic transducers and cabling are located in the main steam tunnel where the radiation dose rate levels are elevated and, thus, are inaccessible during normal plant operations. As such, repair of an LEFM that degrades to the Maintenance or Fail mode may

have to be delayed until the next refueling outage or require an unscheduled plant shutdown due to the high radiation levels.

3.2 General Design Criteria

The NRC staff reviewed this LAR for any changes that may alter the NRC SE for the MUR (Reference 4) as it applies to draft GDC 1. Based on this evaluation, compliance with draft GDC 1 is not impacted, and the staff concludes that systems and components essential to the prevention of accidents that could affect the public health and safety or mitigate their consequences are still designed, fabricated, and erected to quality standards commensurate with the importance of the safety function to be performed.

The MUR license amendment approved by the NRC also included the licensee's safety analyses performed for MUR operation, which justified increasing the licensed thermal power at Peach Bottom to 4,016 MWt. The requested license power level in the MUR LAR was 1.66 percent above the pre-MUR power level of 3,951 MWt. The actual power increase is governed by the results of the core thermal power uncertainty calculation, which currently allows for operation up to 4,016 MWt, 1.66 percent above 3,951 MWt.

The proposed license amendments for expanded actions for LEFM conditions does not increase the licensed thermal power level and will not cause the thermal power level of the currently approved safety limits to be exceeded for the anticipated operational occurrences (AOOs) and the postulated accidents. The proposed intermediate power levels are less than the power level at which the AOOs, the ECCS, and the loss-of-coolant accident analyses were performed in accordance with Appendix K to 10 CFR Part 50. Consequently, the current analysis of record for Peach Bottom transient and accident analyses remains applicable and bounding, and is, therefore, acceptable.

The proposed changes do not affect system design or operation, and therefore, do not create any new accident initiators or increase the probability of a transient or accident previously evaluated. Further, accident mitigation systems are not affected by the proposed changes and will function as designed, and are, therefore, acceptable.

The staff reviewed this LAR for any changes that may alter the NRC SE for the MUR (Reference 4) as it applies to draft GDC 12. Based on this evaluation, compliance with draft GDC 12 is not impacted, and the staff concludes that instrumentation and controls are still provided, as required, to monitor and maintain variables within prescribed operating ranges.

3.3 LEFM Topical Report Criteria

The NRC SE for the MUR LAR (Reference 4) approved TRM Section 3.20, based on alignment with the NRC's SEs for use of the Caldon Topical Reports ER-80P and ER-157P. The staff's evaluation of this LAR is based on evaluating the changes to TRM Section 3.20 to confirm continued alignment with the nine criteria established by these two topical report SEs. The NRC SE for the MUR LAR discusses these nine criteria and provides the original basis for approval of the MUR LAR. The SE for this LAR confirms or updates those criteria as they apply to the proposed changes.

Criterion 1

The licensee should discuss the maintenance and calibration procedures that will be implemented with the incorporation of the LEFM. These procedures should

include processes and contingencies for an inoperable LEFM and the effect on thermal power measurement and plant operation.

Calibration and Maintenance

The licensee stated that the proposed changes will not affect the calibration and maintenance procedures as described in the MUR LAR (Reference 3) for the LEFM system.

The licensee also stated that for the flow measurement by the FW flow nozzle, existing procedures require the calibration of the FW flow nozzle instrument loop every refueling outage. If measurement of FW flow is transferred from an LEFM to the FW flow nozzle, VCF is applied to the FW flow nozzle measurement. The VCF is based on inputs obtained within 24 hours from the time that the LEFM went into Check or Fail mode or was otherwise removed from service. In this LAR, the licensee stated that these actions will ensure the accuracy of the CTP calculation, while relying on FW flow measurement from the FW flow nozzle.

Based on a review of the information provided by the licensee in the MUR LAR (Reference 3), the NRC staff finds that the proposed changes do not affect the calibration and maintenance procedures.

LEFM Inoperability

The licensee stated that the disposition of Criterion 1, "LEFM Inoperability," contained in the MUR LAR (Reference 3) is not changed by this LAR, with the exception of the discussion of TRM Section 3.20 (Reference 3, Section 3.3.4, fifth paragraph of corresponding section "LEFM Inoperability"), which is replaced by the discussion below.

Simple Decision-Making

The licensee stated that the range of decisions and actions facing the operator will not be fundamentally different or made more complex by the proposed changes than those on which Peach Bottom operators have been trained on and which have been implemented since the LEFM system was commissioned in 2002. The licensee further stated that online continuous monitoring of system parameters generates plant monitoring system alarms in the control room that immediately alert the operator to a change in status of an LEFM. If the LEFM is not restored to normal status, the operators must reduce power by 1 to 34 MWt, depending on the LEFM malfunction, by lowering reactor recirculation flow within 72 hours of the initial failure. Additionally, for an LEFM retained in the Maintenance mode, operators must realign the associated FW flow nozzle measurement input to the plant CTP calculation back to the LEFM by the end of the 72-hour TRM completion time using similar plant monitoring system computer input actions.

If it is not possible to calibrate the FW flow nozzle to its associated LEFM, the proposed changes to TRM, Section 3.20, Items B.1.1, D.1.1, and F.1, would require that power be reduced to a level supported by the uncertainty analysis after 2 hours. The proposed intermediate power levels are specified in TRM Table 3.20-1 for LEFM(s) in the Check mode or directly in the compensatory measures for an LEFM in the Fail mode.

In the LAR, the licensee noted that there are no new alarms or operator actions and no changes to operator response times introduced due to this proposed TRM change. However, the licensee stated that a minor revision to existing operating procedures would be made to reflect

the proposed intermediate power levels. As described by the licensee, because the proposed revision to TRM Section 3.20 has only a minor impact on existing operating procedures by adding intermediate power levels for when an LEFM(s) enters a non-normal status, the revision would only have a minor impact on human factors in the areas of human performance and operator training. As such, the licensee noted that no additional training would be required to operate the plant due to this proposed TRM revision.

NUREG-1764, Revision 1, Appendix A, "Generic Human Actions that are Risk-Important," lists generic operator actions for boiling and pressurized water reactors that are considered risk-important or potentially risk-important. Routine actions to respond to control room alarms and maintain licensed core thermal power are not included as risk-important or potentially risk-important operator actions in Appendix A to NUREG-1764. Therefore, the NRC staff finds that the human actions associated with expanding the number of intermediate power levels associated with the LEFM CheckPlus system failure modes from one to four is not risk-important or potentially risk-important, as described in Appendix A to NUREG-1764. In addition, the NRC staff's qualitative assessment of the risk associated with the proposed changes, as described in Section 2.3.5 of NUREG-1764, does not elevate the level of human factors review required. Therefore, the NRC staff finds that the proposed changes are low risk, and a Level III human factors review based on the guidance in NUREG-1764 is appropriate.

The NRC staff reviewed the proposed changes to operator actions described in the LAR and finds that the proposed changes are limited to simple decision-making changes associated with responding to the control room alarm for an LEFM system abnormal condition and determining the appropriate intermediate power level for the abnormal LEFM condition. No changes are proposed to the existing control room alarm human-system interface or operator response times. Operators will continue to use existing procedures to calibrate the FW flow nozzles, transfer core thermal power inputs, and reduce reactor power, if necessary. Minor procedure changes have been identified by the licensee, and the impact on operator training has been assessed. The NRC staff finds that the licensee's proposed changes do not overly rely on human actions, and the proposed changes appropriately consider what operator actions need to be taken and what training is required.

Conservative Plant Operations

The licensee stated that conservative plant operation under the new proposed compensatory measures starts with the calculations of the LEFM, FW flow nozzle, and total power uncertainties on which the proposed changes to the LEFM system compensatory measures are based. The NRC staff finds that the licensee used NRC-approved and industry-accepted methodologies and conservative assumptions to provide margin to ensure that the plants will not operate above the licensed thermal power. Based on the use of NRC-approved methods and an independent review of referenced calculations, the NRC staff finds that the proposed changes continue to ensure conservative plant operation.

Appendix K to 10 CFR Part 50 allows licensees to use a power level less than 1.02 times the rated thermal power (but not less than the licensed power level) for the safety analyses, but not a power level less than the licensed power level based on the use of state-of-the-art FW flow measurement devices that provide a more accurate calculation of power. The proposed intermediate power levels are less than the current licensed thermal power. Therefore, the safety limits for the AOOs and the postulated accidents at the intermediate power levels will be bounded by that of the analyzed events at the current licensed thermal power. This satisfies the

requirements described in the NRC's Standard Review Plan, Chapter 15 (Reference 8) to analyze the plant's responses to postulated events.

In sum, based on the above considerations regarding calibration and maintenance, simple decision-making, and conservative plant operation, the NRC staff concludes that the licensee has adequately addressed Criterion 1.

Criterion 2

For plants that currently have LEFMs installed, provide an evaluation of the operational and maintenance history of the installation and confirm that the installed instrumentation is representative of the LEFM system and bounds the analysis and assumptions set forth in Topical Report ER-80P.

The licensee stated that the Peach Bottom LEFM system installed instrumentation is representative and bounded by the analysis and assumptions set forth in Topical Report ER-80P (Reference 10). The licensee further noted that a review of the maintenance history of the LEFM system since January 2011 indicates the LEFM system continues to be highly reliable.

As described by the licensee, since implementation of the MUR amendments in 2018, there were no instances for Unit 3 and one instance for Unit 2 when an LEFM was in the Check mode requiring maximum allowable power level reduction. In that instance, Unit 2 power was reduced to 4,010 MWt in accordance with the TRM requirements. Additionally, the licensee stated that the Unit 2, Meter 1 transducer coupling has become degraded and has resulted in this LEFM entering the Check mode several times for short periods of time. The licensee stated that a forced outage is required to troubleshoot and repair this LEFM.

The licensee stated that it continues to follow an LEFM system preventive maintenance program based on vendor recommendations, industry lessons learned, and performance data reviews. Further, transducers and LEFM electronics are replaced as determined to be necessary by a review of the equipment's operational history by the LEFM system vendor.

Based on an independent review of the above considerations, the NRC staff concludes that the licensee has adequately addressed Criterion 2.

Criterion 3

The licensee should confirm that the methodology used to calculate the uncertainty of the LEFM in comparison to the current feedwater instrumentation is based on accepted plant setpoint methodology (with regard to the development of instrument uncertainty). If an alternative approach is used, the application should be justified and applied to both venturi and the LEFM for comparison.

The licensee stated that the LEFM system uncertainty calculation methodology continues to be based on the Peach Bottom plant setpoint methodology as described in Attachment 1 to the MUR LAR (Reference 3). The calculation of the FW flow nozzle uncertainty is also based on the Peach Bottom plant setpoint methodology. The Peach Bottom setpoint methodology is based on NRC-approved General Electric Topical Report NEDC-31336P-A, "General Electric Instrument Setpoint Methodology" (Reference 17).

The methodology for combining the FW flow nozzle and LEFM uncertainties is to determine the total mass flow uncertainty and then combine this with other plant-specific parameters to calculate the total power uncertainty. This is unchanged from the MUR LAR (Reference 3).

Based on the continued use of NRC-approved methodologies and consistency with Regulatory Guide 1.105, the NRC staff concludes that the licensee has adequately addressed Criterion 3.

Criterion 4

For plant installation where the ultrasonic meter (including LEFM) was not installed with flow elements calibrated to a site-specific piping configuration (flow profiles and meter factors are not representative of the plant-specific installation), licensees should provide additional justification for its use. The justification should show that the meter installation is either independent of the plant-specific flow profile for the stated accuracy, or that the installation can be shown to be equivalent to known calibrations and plant configurations for the specific installation, including the propagation of flow profile effects at higher Reynolds numbers. Additionally, for previously installed calibrated elements, licensees should confirm that the piping configuration remains bounding for the original LEFM installation and calibration assumptions.

The licensee stated the disposition of this criterion is not changed by this LAR from that provided in Attachment 1 to the MUR LAR (Reference 3), as reviewed and approved by the NRC.

Based on a review of the information provided by the licensee in the MUR LAR (Reference 3), the NRC staff finds that conformity with Criterion 4 has not changed. As such, the NRC staff concludes that the licensee has adequately addressed Criterion 4.

Criterion 5

Continued operation at the pre-failure power level for a pre-determined time and the decrease in power that must occur following that time are plant-specific and must be acceptably justified.

The licensee stated that justification for continued operation at $\leq 4,016$ MWt for up to 72 hours with one or more LEFMs either in Fail or Check mode is not changed from that provided in Attachment 1 to the MUR LAR (Reference 3), as reviewed and approved by the NRC.

Justification for the required decreases in power by the end of the TRM-required compensatory measures completion time for each of the proposed intermediate LEFM conditions was provided by the licensee in the MUR LAR (Reference 3) in the response to Criterion 1.

Based on a review of the information provided by the licensee in this LAR (Reference 1) and the discussion in the "LEFM Inoperability" section under Criterion 1, the NRC staff concludes that the licensee has adequately addressed Criterion 5.

Criterion 6

A CheckPlus operating with a single failure is not identical to an LEFM Check. Although the effect on hydraulic behavior is expected to be negligible, this must

be acceptably quantified if a licensee wishes to operate using the degraded CheckPlus at an increased uncertainty.

The licensee stated the disposition of this criterion is not changed by this LAR from that provided in Attachment 1 to the MUR LAR (Reference 3), as reviewed and approved by the NRC.

Based on a review of the information provided by the licensee in the MUR LAR (Reference 3), the NRC staff finds that conformity with Criterion 6 has not changed. As such, the NRC staff concludes that the licensee has adequately addressed Criterion 6.

Criterion 7

An applicant with a comparable geometry can reference the findings in Section 3.2.1 of the NRC staff's SE for Caldon Engineering Report ER-157P (Reference 7) to support a conclusion that downstream geometry does not have a significant influence on CheckPlus calibration. However, CheckPlus test results do not apply to a Check and downstream effects with use of a CheckPlus with disabled components that make the CheckPlus comparable to a Check must be addressed. An acceptable method is to conduct applicable Alden Laboratory tests.

The licensee stated the disposition of this criterion is not changed by this LAR from that provided in Attachment 1 to the MUR LAR (Reference 3), as reviewed and approved by the NRC.

Based on a review of the information provided by the licensee in the MUR LAR (Reference 3), the NRC staff finds that conformity with Criterion 7 has not changed. As such, the NRC staff concludes that the licensee has adequately addressed Criterion 7.

Criterion 8

Any applicant that requests a MUR with the upstream flow straightener configuration discussed in Section 3.2.2 of the NRC SE for Caldon Engineering Report ER-157P (Reference 7) should provide justification for claimed CheckPlus uncertainty that extends the justification provided in Caldon Engineering Report ER-790 (Reference 13). Since the evaluation in Caldon Engineering Report ER-790 does not apply to the Check, a comparable evaluation must be accomplished if a Check is to be installed downstream of a tubular flow straightener.

The licensee stated the disposition of this criterion is not changed by this LAR from that provided in Attachment 1 to the MUR LAR (Reference 3), as reviewed and approved by the NRC.

Based on a review of the information provided by the licensee in the MUR LAR (Reference 3), the NRC staff finds that conformity with Criterion 8 has not changed. As such, the NRC staff concludes that the licensee has adequately addressed Criterion 8.

Criterion 9

An applicant assuming large uncertainties in steam moisture content should have an engineering basis for the distribution of the uncertainties or, alternatively,

should ensure that their calculations provide margin sufficient to cover the differences shown in Figure 1 of Caldon Report ER-764 (Reference 14).

The licensee stated the disposition of this criterion is not changed by this LAR from that provided in Attachment 1 to the MUR LAR (Reference 3), as reviewed and approved by the NRC.

Based on a review of the information provided by the licensee in the MUR LAR (Reference 3), the NRC staff finds that conformity with Criterion 9 has not changed. As such, the NRC staff concludes that the licensee has adequately addressed Criterion 9.

Based on the evaluation discussed above, the NRC staff concludes that the licensee has sufficiently addressed the nine NRC criteria for use of Caldon Topical Reports ER-80P (Reference 10, nonpublic) and ER-157P (Reference 11, nonpublic), and is consistent with the guidance in RIS 2002-03 (Reference 6).

3.4 Technical Evaluation Conclusion

The NRC staff finds the proposed changes to the TRM acceptable because the licensee demonstrated, through justifiable assumptions and analyses, that the regulatory requirements in draft GDC 1 and 12, and 10 CFR Part 50, Appendix K, continue to be met.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Pennsylvania State official was notified of the proposed issuance of the amendments on February 11, 2019. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement 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 Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (83 FR 55566). Accordingly, the amendments meet the eligibility criteria for 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.

6.0 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) there is reasonable assurance that such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

7.0 REFERENCES

1. Exelon letter to NRC, "Peach Bottom, Units 2 and 3, License Amendment Request – Expanded Actions for LEFM Conditions," dated August 27, 2018 (Agencywide Documents Access and Management (ADAMS) Accession No. ML18239A355).
2. SECY-92-223, "Resolution of Deviations Identified During the Systematic Evaluation Program," dated September 18, 1992 (ADAMS Accession No. ML12256B290).
3. Exelon letter to NRC, "Peach Bottom Atomic Power Station, Units 2 and 3 – Request for License Amendment Regarding Measurement Uncertainty Recapture Power Uprate," dated February 17, 2017 (ADAMS Accession No. ML17048A444).
4. NRC letter to Exelon, "Peach Bottom Atomic Power Station, Units and 3 – Issuance of License Amendments Re: Measurement Uncertainty Recapture Power Uprate," dated November 15, 2017 (ADAMS Accession No. ML17286A013).
5. NRC Regulatory Guide 1.105, Revision 3, "Setpoints for Safety-Related Instrumentation," dated December 1999 (ADAMS Accession No. ML993560062).
6. NRC Regulatory Issue Summary (RIS) 2002-03, "Guidance on the Content of Measurement Uncertainty Recapture Power Uprate Applications," dated January 31, 2002 (ADAMS Accession No. ML013530183).
7. NRC letter to Cameron, "Final Safety Evaluation for Cameron Measurement Systems Engineering Report ER-157P, Revision 8, 'Caldon Ultrasonics Engineering Report ER-157P, Supplement to Topical Report ER-80P: Basis for Power Uprate with the LEFM Check or CheckPlus System' (TAC No. ME1321)," dated August 16, 2010 (ADAMS Package Accession No. ML101730203).
8. NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," Chapter 18, "Human Factors Engineering," Revision 3, dated December 2016 (ADAMS Accession Nos. ML070710376 and ML16125A114 for Chapters 15 and 18, respectively).
9. NUREG-1764, Revision 1, "Guidance for the Review of Changes to Human Actions," dated September 2007 (ADAMS Accession No. ML072640413).
10. Caldon Engineering Report ER-80P, Revision 0, "Improving Thermal Power Accuracy and Plant Safety while Increasing Operating Power Level Using the LEFM Check System," issued March 1997 (non-public).
11. Caldon Ultrasonics Engineering Report ER-157P, Revision 8, "Supplement to Caldon Topical Report ER-80P: Basis for Power Uprates with the LEFM Check or CheckPlus System," dated May 2008 (ADAMS Accession No. ML081720324, non-public).
12. NRC letter to TU Electric (C. Lance Terry), "Comanche Peak Steam Electric Station, Units 1 and 2 – Review of Caldon Engineering Topical Report ER-80P, 'Improving Thermal Power Accuracy and Plant Safety While Increasing Power Level Using the LEFM System,'" dated March 8, 1999 (ADAMS Package Accession No. ML11353A090).

13. Caldon Engineering Report ER-790, Rev. 1, "An Evaluation of the Impact of 55 Tube Permutit Flow Conditioners on the Meter Factor of an LEFM CheckPlus," dated March 2010 (ADAMS Accession No. ML100840026, non-public).
14. Caldon Engineering Report ER-764, Rev. 0, "The Effect of the Distribution of the Uncertainty in Steam Moisture Content on the Total Uncertainty in Thermal Power," dated September 2009 (ADAMS Accession No. ML100820167).
15. Nuclear Energy Institute NEI 98-03, Revision 1, "Guidelines for Updating Final Safety Analysis Reports" (ADAMS Accession No. ML003779028).
16. Regulatory Guide 1.181, "Content of the Updated Final Safety Analysis Report in Accordance with 10 CFR 50.71(e)," dated September 1999 (ADAMS Accession No. ML992930009).
17. GE Nuclear Energy NEDC-31336P-A, Class 3, "General Electric Instrument Setpoint Methodology," dated September 30, 1996 (ADAMS Accession No. ML072950103).

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Date: February 26, 2019

SUBJECT: PEACH BOTTOM ATOMIC POWER STATION, UNITS 2 AND 3 – ISSUANCE OF AMENDMENT NOS. 324 AND 327 RE: EXPANDED ACTIONS FOR LEADING EDGE FLOW METER CONDITIONS (EPID L-2018-LLA-0230) DATED FEBRUARY 26, 2019

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