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

March 1, 2012

Mr. Michael J. Pacilio
President and Chief Nuclear Officer
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: CLINTON POWER STATION, UNIT NO. 1 - ISSUANCE OF AMENDMENT RE: REQUEST TO MODIFY TECHNICAL SPECIFICATION 3.1.2, "REACTIVITY ANOMALIES" (TAC NO. ME6530)

Dear Mr. Pacilio:

The U.S. Nuclear Regulatory Commission (NRC, the Commission) has issued the enclosed Amendment No. 198 to Facility Operating License No. NPF-62 for the Clinton Power Station, Unit No. 1 (CPS). The amendment is in response to your application dated June 13, 2011 (Agencywide Documents Access and Management Systems (ADAMS) Accession No. ML111650145).

The amendment modifies CPS Limiting Condition for Operation Technical Specification 3.1.2, "Reactivity Anomalies" through a revision to the method for calculating core reactivity for the purpose of performing an anomaly check.

A copy of the Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,

Joel S. Wiebe, Senior Project Manager
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-461

Enclosures:
1. Amendment No. 198 to NPF-62
2. Safety Evaluation

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

EXELON GENERATION COMPANY, LLC

DOCKET NO. 50-461

CLINTON POWER STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 198
License No. NPF-62

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Exelon Generation Company, LLC (the licensee), dated June 13, 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 Title 10 of the Code of Federal Regulations (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.

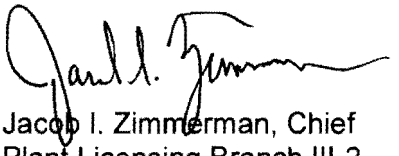
2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. NPF-62 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, as revised through Amendment No. 198, are hereby incorporated into this license. Exelon Generation Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of its date of issuance and shall be implemented within 60 days of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



Jacob I. Zimmerman, Chief
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical
Specifications and Facility Operating License

Date of Issuance: March 1, 2012

ATTACHMENT TO LICENSE AMENDMENT NO. 198

FACILITY OPERATING LICENSE NO. NPF-62

DOCKET NO. 50-461

Replace the following pages of the Facility Operating License and Appendix "A" Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove	Insert
License NPF-62 Page 3	License NPF-62 Page 3
TSs 3.1-5 3.1-6	TSs 3.1-5 3.1-6

(4) Exelon Generation Company, pursuant to the Act and to 10 CFR Parts 30, 40, and 70, to receive, possess, and use at any time any byproduct, source and special nuclear material as sealed neutron sources for reactor startup, sealed sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;

(5) Exelon Generation Company, pursuant to the Act and 10 CFR Parts 30, 40, and 70, to receive, possess, and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components;

(6) Exelon Generation Company, pursuant to the Act and 10 CFR Parts 30, 40, and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility. Mechanical disassembly of the GE14i isotope test assemblies containing Cobalt-60 is not considered separation; and

(7) Exelon Generation Company, pursuant to the Act and 10 CFR Parts 30, to intentionally produce, possess, receive, transfer, and use Cobalt-60.

C. This license shall be deemed to contain and is subject to the conditions specified in the Commission's regulations set forth in 10 CFR Chapter I and is subject to all applicable provisions of the Act and to the rules, regulations and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

Exelon Generation Company is authorized to operate the facility at reactor core power levels not in excess of 3473 megawatts thermal (100 percent rated power) in accordance with the conditions specified herein.

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, as revised through Amendment No. 198, are hereby incorporated into this license. Exelon Generation Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3.1 REACTIVITY CONTROL SYSTEMS

3.1.2 Reactivity Anomalies

LCO 3.1.2 The reactivity difference between the monitored core k_{eff} and the predicted core k_{eff} shall be within ± 1% $\Delta k/k$.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Core reactivity difference not within limit.	A.1 Restore core reactivity difference to within limit.	72 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.2.1	Verify core reactivity difference between the monitored core k_{eff} and the predicted core k_{eff} is within ± 1% $\Delta k/k$.	Once within 24 hours after reaching equilibrium conditions following startup after fuel movement within the reactor pressure vessel or control rod replacement AND 1000 MWD/T thereafter during operation in MODE 1

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 198 TO FACILITY OPERATING LICENSE NO. NPF-62

EXELON GENERATION COMPANY, LLC

CLINTON POWER STATION, UNIT NO. 1

DOCKET NO. 50-461

1.0 INTRODUCTION

By letter to the U.S. Nuclear Regulatory Commission (NRC, the Commission) dated June 13, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML111650145), Exelon Generation Company, LLC (EGC, the licensee), requested changes to the facility Operating License NPF-62 for Clinton Power Station, Unit 1 (CPS). The proposed change would revise Technical Specification (TS) Limiting Condition for Operation 3.1.2, "Reactivity Anomalies," to allow performance of the reactivity anomaly surveillance using a comparison of predicted to monitored core reactivity. The reactivity anomaly verification is currently determined by a comparison of predicted vs. monitored control rod density. The proposed method would compare predicted vs. monitored $k_{effective}$ (k_{eff}).

The staff has previously issued a proposed finding that the amendment involves no significant hazards consideration determination as published in the Federal Register on October 4, 2011 (76 FR 61396).

2.0 REGULATORY EVALUATION

Title 10 of the *Code* of *Federal Regulations* (10 CFR) Part 50, Appendix A, General Design Criteria (GDC) 26, "Reactivity control system redundancy and capability," GDC 28, "Reactivity limits," and GDC 29, "Protection against anticipated operational occurrences," require that reactivity within the core be controllable to ensure that subcriticality is achievable and maintainable under cold conditions (most reactive conditions). In addition, the same GDCs specify that applicable fuel design limits must not be exceeded during normal operations and anticipated operational occurrences.

In Section 4 of its submittal, the licensee identified the applicable regulatory requirements. Specifically, the licensee stated:

> General Design Criteria (GDC) 26, 28, and 29 require that reactivity be controllable such that subcriticality is maintained under cold conditions and specified applicable fuel design limits are not exceeded during normal operations and anticipated operational occurrences (AOO). The reactivity anomaly check required by the CPS TS in LCO 3.1.2 serves to partly satisfy the above GDCs by verifying that core reactivity remains within expected/predicted values.

Ensuring that no significant reactivity anomaly exists provides confidence of adequate shutdown margin as well as providing verification that the assumptions of safety analyses associated with core reactivity remain valid.

To conduct their review, the staff used the boiling-water reactor Improved Standard Technical Specifications (ISTS), NUREG-1434, Revision 3, which was approved by the NRC, and is an acceptable method of showing consistency with the regulatory standards.

3.0 TECHNICAL EVALUATION

The licensee proposed changes to CPS's TS and associated bases to reflect a new method of performing the reactivity anomaly check. The limiting conditions for operation (LCOs) and Surveillance Requirements (SRs) contained within the TS respectively specify the minimum requirements for ensuring safe operation of the plant and the testing, calibration, or inspection needed of systems and components to ensure those requirements are met. The revised LCO and SR are provided below.

The purpose of the reactivity anomaly surveillance is to compare the observed reactivity behavior of the core at hot operating conditions with the expected reactivity behavior calculated prior to the start of operation.

Currently, CPS TS require a comparison between predicted control rod density that is calculated prior to the start of operation for a particular cycle to an actual control rod density during the cycle. The comparison is done, as required by Surveillance Requirement (SR) 3.1.2.1, once within 24 hours after reaching equilibrium conditions following startup after fuel movement within the reactor pressure vessel or control rod replacement and each 1000 MWD/T thereafter during operations in Mode 1.

The current method of performing the reactivity anomaly uses rod density for the comparison primarily because early core monitoring systems did not calculate core critical k_{eff} values for comparison to design values. Rod density was used instead as a convenient representation of core reactivity. Allowing the use of a direct comparison of k_{eff}, as opposed to rod density, provides for a more direct measurement of core reactivity conditions and eliminates the limitations that exist for performing the core reactivity comparisons with rod density.

PROPOSED CHANGES

The Condition statements will not be changed. This proposed TS change will also not change the frequency of the SR, only the method by which the reactivity anomaly SR is performed. However, the SR will be re-worded to replace rod density with k_{eff} as appropriate.

The current LCO 3.1.2 and proposed LCO 3.1.2 are, respectively:

The reactivity difference between the monitored rod density and the predicted rod density shall be within ±1% Δk/k.

> The reactivity difference between the monitored core k_{eff} and the predicted core k_{eff} shall be within ±1% Δk/k.

The current SR 3.1.2.1 and proposed SR 3.1.2.1 are respectively:

> Verify core reactivity difference between the monitored rod density and the predicted rod density is within ±1% Δk/k.
>
> Verify core reactivity difference between the monitored core k_{eff} and the predicted core k_{eff} is within ±1% Δk/k.

The submittal stated that if a significant deviation between the reactivity observed during operation and the expected reactivity occurs, the reactivity anomaly surveillance alerts the reactor operating staff of a potentially anomalous situation, indicating that something in the core design process, the manufacturing of the fuel, or in the plant operation may be different than was assumed. The licensee stated that this situation would trigger an investigation and further actions, as needed.

The licensee also stated that:

> The current method for the development of the reactivity anomaly curves used to perform the TS surveillance actually begins with the predicted critical k_{eff} at rated conditions and the companion rod patterns derived using those predicted values of k_{eff}. A calculation is made of the number of notches inserted in the rod patterns, and also the number of average notches required to make a change of ± 1 % Δk/k around the predicted critical k_{eff}. The notches are converted to rod density and plotted with an upper and lower bound representing the ± 1% Δk/k acceptance band as a function of cycle exposure. This curve is then used as the predicted rod density during the cycle. In effect, the comparison is still based on critical k_{eff} with a "translation" of acceptance criteria to rod density.

The licensee further stated that CPS utilizes the NRC-approved Global Nuclear Fuel (GNF) 3D MONICORE core monitoring software system. The latest version of this product incorporates the NRC-approved PANACEA Version 11 (i.e., PANAC11) core simulator code to calculate parameters such as core nodal powers, fuel thermal limits, etc., using actual, measured plant input data. PANAC11 is the same 3D core simulator code currently used in CPS core design and licensing activities. When a 3D MONICORE core monitoring case is run, the core k_{eff}, as computed by PANAC11, is also calculated and printed directly on each 3D MONICORE case output. This value can then be directly compared to the predicted value of k_{eff} as a measure of reactivity anomaly.

The revised method for evaluating a potential reactivity anomaly compares the measured (i.e., monitored) core k_{eff} to predicted core k_{eff}. Measured core k_{eff} is calculated by the 3D core simulator model in the plant's core monitoring system based on measured plant operating data.

The predicted core k_{eff}, as a function of cycle exposure, is developed prior to the start of each operating cycle and incorporates benchmarking of exposure-dependent 3D core simulator k_{eff} behavior in previous cycles and any fuel vendor recommended adjustments due to planned changes in fuel design, core design, or operating strategy for the upcoming cycle.

The NRC staff reviewed the licensee's submittal and related documentation, including the CPS TS, ISTS, and the updated final safety analysis report. The NRC staff concurs with the licensee that while being a convenient measurement of core reactivity, control rod density has its limitations. All control rod insertion does not have the same impact on core reactivity. Control rods located in core periphery and shallow rods have little impact on reactivity while deeply inserted central control rods have a large effect. Thus, it is not uncommon for reactivity anomaly concerns to arise during operation simply because of greater use of near-edge or shallow control rods than anticipated, when in fact no true anomaly exists. The staff believes that comparing monitored to predicted k_{eff} instead of monitored to predicted rod density, eliminates the inherent limitations of the current method and replaces it with a more realistic comparison using a straightforward approach. The staff finds that by ensuring that no significant reactivity anomaly exists, the licensee provides reasonable assurance of adequate shutdown margin as well as providing verification that the assumptions of safety analyses associated with core reactivity remain valid.

The NRC staff concurs with the licensee that the proposed changes should not affect transient and accident analyses because only the method of performing the reactivity anomaly surveillance is changing. The staff finds that the proposed method will provide an adequate estimate as discussed above. Furthermore, the reactivity anomaly check will continue to be performed by the licensee at the current TS required frequency.

The NRC staff review determined that the licensee's proposed amendment is consistent with the ISTS (NUREG-1434, Revision 3.0) for BWR/6. The Reactivity Anomaly LCO in the BWR/6 ISTS uses the k_{eff} comparison, as opposed to the control rod density comparison. The staff notes that the proposed change is similar to changes previously approved in Amendments 263 and 207 for the Edwin I. Hatch Nuclear Plant on November 4, 2010, for Units 1 and 2, respectively.

The NRC staff finds that the proposed license amendment request is acceptable based on the considerations that (1) the proposed methodology is based on more realistic and reliable comparison of monitored to predicted k_{eff} values, that (2) the most recently updated NRC-approved methodologies will be used to perform the analysis, and that (3) ensuring that no significant reactivity anomaly exists provides reasonable assurance of adequate shutdown margin as well as providing verification that the assumptions of safety analyses associated with core reactivity remain valid. The staff, therefore, concludes that the proposed amendment of the CPS TS continues to meet GDCs 26, 28, and 29, and therefore, is acceptable.

4.0 STATE CONSULTATION

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

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes 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 amendment involves 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 amendment involves no significant hazards consideration, and there has been no public comment on such finding (October 4, 2011, 76 FR 61396). Accordingly, the amendment meets the eligibility criteria for categorical exclusions 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 amendment.

6.0 CONCLUSIONS

The Commission has concluded, based on 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: M. Razzaque, DSS/SRXB; A. Kevin Heller, Anthony Attard, DSS/SNPB

Date of issuance: March 1, 2012

Mr. Michael J. Pacilio
President and Chief Nuclear Officer
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

March 1, 2012

SUBJECT: CLINTON POWER STATION, UNIT NO. 1 - ISSUANCE OF AMENDMENT RE: REQUEST TO MODIFY TECHNICAL SPECIFICATION 3.1.2, "REACTIVITY ANOMALIES" (TAC NO. ME6530)

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Sincerely,
/RA/

Joel Wiebe, Senior Project Manager
Plant Licensing Branch III-2
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