March 23, 2001

Mr. James A. Hutton
Director-Licensing
Exelon Generation Company
Nuclear Group Headquarters
Correspondence Control
P.O. Box 160
Kennett Square, PA 19348

SUBJECT: LIMERICK GENERATING STATION, UNIT 2 - ISSUANCE OF AMENDMENT RE: UPDATE THE PRESSURE-TEMPERATURE LIMIT CURVES FOR LIMERICK GENERATION STATION (TAC NO. MB0590)

Dear Mr. Hutton:

The Commission has issued the enclosed Amendment No. 111 to Facility Operating License No. NPF-85 for the Limerick Generating Station, Unit 2. This amendment consists of changes to the Technical Specifications (TSs) in response to your application dated November 20, 2000, and supplemented December 20, 2000.

On January 12, 2001, the licenses held by PECO Energy Company (PECO) for Limerick 1 and 2, were transferred to Exelon Generation Company, LLC (Exelon). By letter dated January 30, 2001, Exelon requested that the U.S. Nuclear Regulatory Commission continue to review and act upon all requests before the Commission which had been submitted by PECO.

This amendment revises TS Figure 3.4.6.1-1, "Minimum Reactor Vessel Metal Temperature vs. Reactor Vessel Pressure." The revision modifies the pressure-temperature (P-T) limits by revising the heatup, cooldown and inservice test limitations for the reactor pressure vessel of Unit 2 to a maximum of 32 effective full power years. The staff limited the applicability of the revised P-T limits until the end of Operating Cycle 7, currently scheduled for April 2003.

A copy of our safety evaluation is also enclosed. Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

/RA/

Christopher Gratton, Sr. Project Manager, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-353

Enclosures: 1. Amendment No. 111 to License No. NPF-85
2. Safety Evaluation

cc w/encls: See next page

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cc w/encls: See next page
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EXELON GENERATION COMPANY

DOCKET NO. 50-353

LIMERICK GENERATING STATION, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 111
License No. NPF-85

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

   A. The application for amendment by PECO Energy Company (the licensee at the time) dated November 20, 2000, as supplemented December 20, 2000, 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 Facility Operating License No. NPF-85 is hereby amended to read as follows:

   Technical Specifications

   The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, as revised through Amendment No. 111 , are hereby incorporated into this license. Exelon Generating 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 30 days.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

James W. Clifford, Chief, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: March 23, 2001

ATTACHMENT TO LICENSE AMENDMENT NO. 111

FACILITY OPERATING LICENSE NO. NPF-85

DOCKET NO. 50-353

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

Remove	Insert
3/4 4-20	3/4 4-20
3/4 4-18	3/4 4-18
3/4 4-19	3/4 4-19
B3/4 4-5	B3/4 4-5
B3/4 4-7	B3/4 4-7

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED AMENDMENT NO. 111 TO FACILITY OPERATING LICENSE NO. NPF-85

EXELON GENERATION COMPANY

LIMERICK GENERATING STATION, UNIT 2

DOCKET NO. 50-353

1.0 INTRODUCTION

On November 20, 2000, as supplemented by letter dated December 20, 2000, PECO Energy Company (PECO, the licensee at the time) submitted a license amendment request to update the pressure-temperature (P-T) limit curves for the Limerick Generating Station (LGS), Unit 2. By letter dated January 30, 2001, Exelon Generation Company, LLC, successor to PECO Energy Company, adopted this license amendment request. The proposed amendment revised TS Figure 3.4.6.1-1, "Minimum Reactor Vessel Metal Temperature vs. Reactor Vessel Pressure," modifying the P-T limits by revising the heatup, cooldown and inservice test limitations for the reactor pressure vessel (RPV) of Unit 2 to a maximum of 32 effective full power years (EFPY). The letter of December 20, 2000, reduced the scope of this amendment request and did not change the initial proposed no significant hazards consideration determination or expand the amendment beyond the scope of the initial notice.

2.0 BACKGROUND

The U.S. Nuclear Regulatory Commission (NRC) has established requirements in Appendix G of Part 50 to Title 10 of the *Code of Federal Regulations* (10 CFR Part 50, Appendix G), to protect the integrity of the reactor coolant pressure boundary in nuclear power plants. The Appendix to Part 50 requires the P-T limits for an operating plant to be at least as conservative as those that would be generated if the methods of Appendix G to Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (Appendix G to the ASME Code) were applied. The methodology of Appendix G to the ASME Code postulates the existence of a sharp surface flaw in the RPV that is normal to the direction of the maximum applied stress. For materials in the beltline and upper and lower head regions of the RPV, the maximum flaw size is postulated to have a depth that is equal to one-fourth of the thickness and a length equal to 1.5 times the thickness. For the case of evaluating RPV nozzles, the surface flaw is postulated to propagate parallel to the axis of the nozzle's corner radius. The basic parameter in Appendix G to the ASME Code for calculating P-T limit curves is the stress intensity factor, K_I, which is a function of the stress state and flaw configuration. The methodology requires that licensees determine the reference stress intensity (K_{Ia}) factors, which vary as a function of temperature, from the reactor coolant system (RCS) operating temperatures, and from the adjusted reference temperatures (ARTs) for the limiting materials in the RPV. Thus, the critical locations in the RPV beltline and head regions are the 1/4-thickness (1/4T) and 3/4-thickness (3/4T) locations, which correspond to the points of the crack tips if the flaws are initiated and grown from the inside and outside surfaces of the vessel, respectively.

Regulatory Guide (RG) 1.99, Revision 2, provides an acceptable method of calculating ARTs for ferritic RPV materials; the methods of RG 1.99, Revision 2, include methods for adjusting the ARTs of materials in the beltline region of the RPV, where the effects of neutron irradiation may induce an increased level of embrittlement in the materials.

The methodology of Appendix G requires that P-T curves must satisfy a safety factor of 2.0 on stress intensities arising from primary membrane and bending stresses during normal plant operations (including heatups, cooldowns, and transient operating conditions), and a safety factor of 1.5 on stress intensities arising from primary membrane and bending stresses when leak rate or hydrostatic pressure tests are performed on the RCS. Table 1 to 10 CFR Part 50, Appendix G, provides the NRC staff's criteria for meeting the P-T limit requirements of Appendix G to the ASME Code and the minimum temperature requirements of the rule for bolting up the vessel during normal and pressure testing operations.

PECO's November 20, 2000, amendment request proposed that the updated P-T limit curves for the LGS Unit 2, be applicable to a maximum of 32 EFPY. The proposed fluence value for 32 EFPY was determined by extrapolation from the value used for the current P-T curves. The NRC staff's review of the information provided in the amendment request revealed that LGS Unit 2 is lacking plant-specific dosimetry and calculations and that the original fluence value was reduced by averaging in the dosimetry and (one dimensional) calculational neutron fluence values from similarly designed plants. The NRC staff found that the value was not credible and related its concerns about the methods used for calculating neutron fluence values in a conference call with the licensee on December 6, 2000. In the letter dated December 20, 2000, the licensee proposed to limit the applicability of the P-T curves through the end of Operating Cycle 7, currently scheduled for April 2003. In the interim, the licensee will perform credible plant-specific calculations and dosimetry and, prior to the end of Operating Cycle 7, will propose revised curves that will be applicable through 32 EFPY.

On March 21, 2001, pursuant to 10 CFR 50.12, the NRC granted an exemption to allow PECO to deviate from the requirements of 10 CFR Part 50, Appendix G, and to use Code Case N-640 as the part of the bases for generating the LGS Unit 2 P-T limit curves for normal operations effective to 32 EFPY and pressure testing conditions effective to 22 EFPY and 32 EFPY.[(1)] The NRC staff's evaluation of the proposed P-T limit curves is, in part, based on this exemption, on the staff's evaluation of the RPV fast neutron fluence, and on the justification for the acceptability of the interim date. The NRC staff's evaluation is given in Section 2.0 of this safety evaluation (SE).

(1) Approval to use Code Case N-640 allows licensees to use the lower bound static initiation fracture toughness value equation (K_{1c} equation) as the basis for establishing the P-T limits in lieu of using the lower bound crack arrest fracture toughness value equation (K_{1a} equation), which is the method invoked by Appendix G to the Code. The NRC staff's bases for approving use of Code Case N-640 is given in the exemption dated March 21, 2001.

2.0 EVALUATION

2.1 Assessment of Neutron Fluence Levels

The NRC staff performed an independent review of the neutron fluence information and values submitted in the PECO letters of November 20, 2000, and December 20, 2000. The staff determined that the information submitted in these letters for calculating the neutron fluence values used in development of the P-T limits was not reflective of the guidance contained in Draft Regulatory Guide DRG-1053, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," September 1999, specifically:

a) the LGS Unit 2 RPV lacks plant-specific dosimetry and pressure vessel fluence calculations,

b) the proposed fluence values were derived from similar plant dosimetry and calculations,

c) most of the dosimetry is from dosimeters placed in the shadow of a 10-inch (schedule 30) jet pump riser pipe,

d) some of the neutron fluence calculations are based on a one-dimensional model,

e) activation and transport cross sections have changed; iron in particular changed in a non-conservative direction, and

f) there is no information on how the neutron spectrum was derived at the location of the dosimeter, especially in the shadow of the jet pump riser.

The staff determined, however, that the dosimetry included some surveillance capsules which were not positioned in adverse locations, thus, making the dosimetry results more reliable. In addition, the staff found that the results from the various types of dosimeters were not strikingly different. In the development of the 32 EFPY fluence value for LGS Unit 2, the licensee made several conservatisms: (1) the proposed curves were estimated for 32 EFPY, but will only be in use through approximately 11 EFPY; (2) the predicted vessel flux was multiplied by a safety factor of 2; (3) when the LGS Unit 2 power level was uprated by 5 percent, the vessel peak fluence was raised by 10 percent from the beginning of life, thus, adding a conservatism of more than 5 percent; and, (4) the assumed fluence value (including the safety factor) is higher than the maximum measured value.

Based on the aforementioned conservatisms and considering the limited time of applicability of the proposed P-T curves, the NRC staff concludes there is reasonable assurance of safety and finds the proposed curves acceptable for use until the end of Operating Cycle 7.

2.2 P-T Limit Curve Assessment

For the LGS Unit 2 RPV, the licensee provided the P-T limit curves for normal operating conditions effective to 32 EFPY and pressure testing conditions effective to 22 EFPY and 32 EFPY. For the normal operating conditions with the core not critical, and for pressure

testing conditions, individual P-T curves were proposed for the lower head in addition to the composite curves proposed for the beltline and nozzle regions of the RPVs. To test the validity of the licensee's proposed curves the NRC staff performed an independent assessment of the licensee's submittal. The NRC staff applied the methodologies of 1995 Edition of Appendix G to the ASME Code and 10 CFR Part 50, Appendix G, as modified by the methodology of ASME Code Case N-640, as the bases for its independent assessment. For the evaluation of the RPV nozzles, the staff also modified the methods of Appendix G to the ASME Code by the nozzle evaluation methods proposed in Appendix 5 of Welding Research Council Bulletin WRC-175, "PVRC [Pressure Vessel Research Council] Recommendations on Toughness Requirements for Ferritic Materials," August 1972.

The staff's assessment also included an independent calculation of the ART values for both the 1/4T and 3/4T locations of the LGS Unit 2 RPV beltline regions based on the neutron fluence specified in the submittal for the LGS Unit 2 RPV effective to 22 and 32 EFPY. For the evaluation of the limiting beltline materials, the staff confirmed that the ARTs and P-T limit curves were based on the methodology of RG 1.99, Revision 2. For the evaluation of the limiting material in the limiting nozzle and lower head evaluations, the staff applied the plant-specific design-basis data provided by the licensee.

The staff determined that PECO's P-T limit methods were based on conservative assumptions that made the proposed P-T limit curves as conservative or slightly more conservative than the P-T limit curves generated by the staff. The staff also confirmed that PECO's P-T limit curves included appropriate minimum temperature requirements that were at least as conservative as those required in Table 1 to 10 CFR Part 50, Appendix G, as exempted and modified by the Code Case methods.

3.0 SUMMARY

Based on the NRC staff's review and evaluation of PECO's proposed P-T limit curves for LGS Unit 2, the staff has determined that the proposed P-T limit curves are consistent with the alternate assessment criteria and methods of ASME Code Case N-640, and satisfy (1) the requirements of 10 CFR 50.60(a), "Acceptance Criteria for Fracture Prevention Measures for Lightwater Nuclear Power Reactors for Normal Operation," (2) Appendix G to 10 CFR Part 50, "Fracture Toughness Requirements," and (3) Appendix G to the 1995 Edition of Section XI of the ASME Code, as exempted by the methods of analyses in the Code Case. However, given that the 32 EFPY neutron fluence calculations for LGS Unit 2 were not credible, the staff concludes that the updated P-T limit curves proposed by PECO will continue to provide an acceptable level of margin and safety, and provide sufficient assurance that the LGS Unit 2 reactor will be operated in a manner that will protect the RPV against brittle fracture only until the end of the Operating Cycle 7. On December 20, 2000, PECO informed the NRC staff that the applicability of the proposed P-T limit curves would be limited to the end of Operating Cycle 7. The proposed curves are, therefore, approved for incorporation into the LGS Unit 2 TSs and for use until the end of Operating Cycle 7.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Pennsylvania 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 (66 FR 11058). Accordingly, the amendment meets 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 amendment.

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) 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 Contributors: J. Medoff
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Date: March 23, 2001