

Mr. James A. Hutton
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Nuclear Group Headquarters
Correspondence Control
P.O. Box 160
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September 15, 2000

SUBJECT: LIMERICK GENERATING STATION, UNIT 1 - ISSUANCE OF AMENDMENT
RE: UPDATE PRESSURE-TEMPERATURE (P-T) LIMIT CURVES
(TAC NO. MA8953)

Dear Mr. Hutton:

The Commission has issued the enclosed Amendment No. 145 to Facility Operating License No. NPF-39 for the Limerick Generating Station, Unit 1. This amendment consists of changes to the Technical Specifications in response to your application dated May 15, 2000, as supplemented August 10, 2000.

This amendment revises the P-T limit curves to be consistent with the alternate criteria of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code Cases N-588 and N-640.

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/

Bartholomew C. Buckley, Sr. Project Manager, Section 2
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-352

Enclosures: 1. Amendment No. 145 to
License No. NPF-39
2. Safety Evaluation

cc w/encls: See next page

Limerick Generating Station, Units 1 & 2

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PECO ENERGY COMPANY

DOCKET NO. 50-352

LIMERICK GENERATING STATION, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 145
License No. NPF-39

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by PECO Energy Company (the licensee) dated May 15, 2000, as supplemented August 10, 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-39 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. 145, are hereby incorporated in the license. PECO Energy 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: September 15, 2000

ATTACHMENT TO LICENSE AMENDMENT NO. 145

FACILITY OPERATING LICENSE NO. NPF-39

DOCKET NO. 50-352

Replace the following pages of the 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

3/4 4-18

3/4 4-18

3/4 4-20

3/4 4-20

B 3/4 4-5

B 3/4 4-5

B 3/4 4-7

B 3/4 4-7

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 145 TO FACILITY OPERATING LICENSE NO. NPF-57
PECO ENERGY COMPANY
LIMERICK GENERATING STATION, UNIT 1
DOCKET NO. 50-352

1.0 INTRODUCTION

On May 15, 2000, PECO Energy Company (PECO) submitted a license amendment request to update the pressure-temperature (P-T) limit curves for the Limerick Generating Station, Unit 1 (LGS Unit 1) (Reference 1). The licensee's request would update the P-T limit curves for a time period that corresponds to the end of the current license. The proposed fluence value of 32 effective full power years (EFPY) was determined by extrapolation from the value used for the current P-T curves. Staff review of the submitted information revealed that LGS Unit 1 is lacking plant-specific dosimetry and calculations and that the original fluence value was reduced from averaging similar plant dosimetry and (one dimensional) calculations. The staff found that the value was not supported by robust data and related those concerns to the licensee in a teleconference on July 12, 2000, and again on July 27, 2000. In a letter dated August 10, 2000 (Reference 2), the licensee proposed to limit the applicability of the P-T curves to April 2002, i.e., to the next refueling outage. In the interim, the licensee will perform plant-specific calculations and evaluate their dosimetry in preparation for a future submittal to revise the curves for 32 EFPY. The August 10, 2000, letter provided clarifying information that did not change the initial no significant hazard consideration determination or expand the scope of the original Federal Register notice.

By letter dated September 7, 2000, the NRC granted PECO an exemption to use Code Cases N-588 and N-640 for the LGS Unit 1 P-T Limits (Reference 3). Pursuant to 10 CFR 50.12, the NRC granted two exemptions to allow PECO to deviate from the requirements of 10 CFR Part 50, Appendix G, and to use Code Cases N-588 and N-640 as the bases for generating the LGS Unit 1 P-T limit curves effective to 22 EFPY and 32 EFPY.⁽¹⁾ The staff's assessment of the proposed P-T limit curves is, in part, based on these exemptions. The staff's complete evaluation is given in Section 3.0 of this safety evaluation.

(1) Approval to use ASME Code Case N-588 allows licensees to evaluate a circumferential weld based on the tensile stresses associated with a postulated circumferential flaw in the weld, and approval to use ASME Code Case N-640 allows licensees to use the lower bound static initiation fracture toughness value equation (K_{Ic} equation) as the basis for establishing the P-T limits in lieu of using the lower bound crack arrest fracture toughness value equation (K_{Ia} equation), which is the method invoked by Appendix G to the ASME Code. The staff's bases for approving these exemptions is given in an SE dated September 7, 2000, enclosed with a letter to PECO granting an exemption to use ASME Code Cases N-588 and N-640 for the Limerick Unit 1 P-T Limits.

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 reactor pressure vessel (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 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.

3.0 EVALUATION

3.1 Assessment of Neutron Fluence Levels

The staff performed an independent review of the neutron fluence information and values submitted in the PECO letters of May 15, 2000, and August 10, 2000. The staff determined that the information submitted in these letters indicates that:

- a) the LGS Unit 1 RPV lacks plant-specific dosimetry and pressure vessel calculations,
- b) the proposed fluence values were derived from similar plant dosimetry and calculations,

- c) most of the dosimetry data is from dosimeters placed in the shadow of a 10-inch (schedule 30) jet pump riser pipe,
- d) the available calculations are one dimensional performed in the 1980s,
- e) activation and transport cross sections have changed, and iron, in particular, changed in a non-conservative direction,
- 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.

On the other hand, the staff determined that the dosimetry included a number of surveillance capsules that were not positioned in adverse locations; thus, the dosimetry information from these other locations is more reliable than the dosimetry that is in the shadow of the jet pump riser. In addition, the results from the type of dosimeters (Fe^{54} , Cu^{63} , Ni^{58} , Co^{59} , etc.) used in BWR4 and BWR5 plants are quite similar and, therefore, provide reliable data. In the evaluation of the LGS Unit 1 32 EFPY fluence value there are several conservatisms: (1) the proposed curves were estimated for 32 EFPY and are to be valid to about 13.5 EFPY; (2) the predicted vessel flux was multiplied by a safety factor of 2; (3) when the LGS Unit 1 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 value, including the safety factor, is higher than the maximum measured value.

Based on the above, and considering the limited time of applicability of the proposed pressure temperature curves, the staff concludes there is reasonable assurance of safety and finds the proposed curves acceptable for use until April 2002.

3.2 P-T Limit Curve Assessment

For the LGS Unit 1 RPV, the licensee provided the P-T limit curves for normal operating conditions 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 nozzles regions of the RPVs. To test the validity of the licensee's proposed curves, the staff performed an independent assessment of the licensee's submittal. The 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 methodologies of ASME Code Cases N-588 and 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 the 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 1 RPV beltline regions based on the neutron fluence specified in the submittal for the LGS Unit 1 RPV effective to 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 ASME Code Case methods.

Based on the above, the NRC staff finds the proposed P-T limit curves conservative and, therefore, acceptable.

4.0 SUMMARY

Based on the staff's review and evaluation of PECO's proposed P-T limit curves for LGS Unit 1, the staff has determined that the proposed P-T limit curves are consistent with the alternate criteria of ASME Code Cases N-588 and N-640, and satisfy the requirements of 10 CFR 50.60, "Acceptance criteria for fracture prevention measures for lightwater nuclear power reactors for normal operation;" Appendix G to 10 CFR Part 50, "Fracture Toughness Requirements;" and Appendix G to the 1995 Edition of Section XI of the ASME Code, as exempted by the methods of analyses in Code Cases N-588 and N-640. However, the NRC staff considers that the 32 EFPY neutron fluence calculations for LGS Unit 1 were not validated. Based on the conservatism discussed in Section 3.1 of this SE, 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 1 reactor will be operated in a manner that will protect the RPV against brittle fracture until April 2002. The proposed curves are, therefore, approved for incorporation into the LGS Unit 1 TSs and for use until April 2002. By letter dated August 10, 2000, PECO stated that the applicability of the proposed P-T limit curves would be limited to April 2002 as stipulated in the note added to Figure 3.4.6.1-1 of the LGS Unit 1 Technical Specifications.

5.0 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.

6.0 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 (65 FR 43051). 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.

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.

8.0 REFERENCES

1. Letter from J. A. Hutton, PECO Energy Company, to U.S. Nuclear Regulatory Commission, "Limerick Generating Station, Unit 1, Technical Specifications Change Request No. 00-02-1, Changes to Reactor Pressure Vessel Pressure-Temperature Limits," dated May 15, 2000.
2. Letter from J. A. Hutton, PECO Energy Company, to U.S. Nuclear Regulatory Commission, "Limerick Generating Station, Unit 1, Technical Specification Change Request No. 00-02-1 Changes to Reactor Pressure Vessel Pressure-Temperature Limits, Supplemental Information," dated August 10, 2000.
3. Letter to J. A. Hutton, PECO Energy Company, from U.S. Nuclear Regulatory Commission, "Limerick Generating Station, Unit 1 - Exemption from the Requirements of 10 CFR Part 50, Section 50.60(a) and Appendix G (TAC No. MA8954)," dated September 7, 2000.

Principal Contributors: J. Medoff
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Date: September 15, 2000