

October 3, 2001

Mr. J. S. Keenan, Vice President
Brunswick Steam Electric Plant
Carolina Power & Light Company
Post Office Box 10429
Southport, North Carolina 28461

SUBJECT: BRUNSWICK STEAM ELECTRIC PLANT UNITS 1 AND 2 - EXEMPTION FROM
THE REQUIREMENTS OF 10 CFR PART 50, APPENDIX G: USE ASME CODE
CASE N-640 IN LIEU OF APPENDIX G OF ASME SECTION XI FOR THE
GENERATION OF UPDATED PRESSURE-TEMPERATURE CURVES

Dear Mr. Keenan:

The Commission has approved the enclosed exemption from specific requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix G, for the Brunswick Steam Electric Plant, Units 1 and 2. This action is in response to your letter of May 1, 2001, concerning Pressure-Temperature limits.

A copy of the exemption and the supporting Safety Evaluation are enclosed. The exemption has been forwarded to the Office of the Federal Register for publication.

Sincerely,

/RA/

Donnie J. Ashley, Project Manager, Section 2
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-325 and 50-324

Enclosures:

1. Exemption
2. Safety Evaluation

cc w/encls: See next page

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Brunswick Steam Electric Plant
Units 1 and 2

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
CAROLINA POWER & LIGHT COMPANY
DOCKET NOS. 50-325 AND 50-324
BRUNSWICK STEAM ELECTRIC PLANT, UNITS 1 AND 2
EXEMPTION

1.0 BACKGROUND

The Carolina Power & Light Company (CP&L, the licensee) is the holder of Facility Operating License Nos. DPR-71 and DPR-62, which authorize operation of the Brunswick Steam Electric Plant, Units 1 and 2 (BSEP). The licenses provide, among other things, that the facility is subject to all rules, regulations, and orders of the U.S. Nuclear Regulatory Commission (NRC, the Commission) now or hereafter in effect.

The facility consists of two boiling-water reactors located in Brunswick County in North Carolina.

2.0 REQUEST/ACTION

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Appendix G, requires that pressure-temperature (P-T) limit curves for BSEP be developed in accordance with the methods invoked by Appendix G to Section XI of the ASME Code.

In summary, by letter dated May 1, 2001, the licensee submitted a request to use an exemption method that would allow CP&L to deviate from complying with the requirements in 10 CFR Part 50, Appendix G, for generating the P-T limit curves for BSEP.

3.0 DISCUSSION

Pursuant to 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50 when (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) when special circumstances are present. These circumstances include the special circumstances that 10 CFR 50.60 requires that all light-water nuclear power reactors must meet the fracture toughness requirements of Appendix G of 10 CFR 50. 10 CFR Part 50, Appendix G requires P-T limit curves to be at least as conservative as limits obtained by following the methods of analysis and the margins of safety of Appendix G of Section XI of the ASME Code. Requests for exemptions to the requirements of 10 CFR Part 50, Appendices G and H, may be submitted pursuant to 10 CFR 50.60(b), which allows licensees to use alternatives to the respective fracture toughness and reactor vessel material surveillance program requirements of the appendices, if an exemption to use the alternatives is granted by the Commission pursuant to 10 CFR 50.12. According to 10 CFR 50.12(a)(1), the Commission may grant exemptions to the requirements of 10 CFR Part 50 if the exemptions are authorized by law, and will not present an undue risk to the public health and safety, and are consistent with the common defense and security.

Based upon a consideration of the licensee's information and the NRC's Safety Evaluation, the staff concludes that granting an exemption under the requirements of 10 CFR 50.12(a)(1) is appropriate.

The Safety Evaluation may be examined, and/or copied for a fee, at the NRC's Public Document Room, located at One White Flint North, 11555 Rockville Pike (first floor), Rockville, Maryland. Publicly available records will be accessible electronically from the ADAMS Public Library component on the NRC Web site, <http://www.nrc.gov> (the Public Electronic Reading Room).

4.0 CONCLUSION

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), the exemption is authorized by law, will not endanger life or property or common defense and security, and is, otherwise, in the public interest. Also, special circumstances are present. Therefore, the Commission hereby grants CP&L an exemption from the requirements of 10 CFR 50, Appendix G, for generating the P-T limit curves for BSEP.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this exemption will not have a significant effect on the quality of the human environment (66 FR 50458).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 3rd day of October 2001.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

John A. Zwolinski, Director
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
REQUEST FOR EXEMPTION FROM 10 CFR PART 50
BY CAROLINA POWER & LIGHT COMPANY TO USE ASME CODE CASE N-640
IN LIEU OF APPENDIX G OF ASME SECTION XI
FOR GENERATION OF PRESSURE-TEMPERATURE LIMIT CURVES
FOR THE BRUNSWICK STEAM ELECTRIC PLANT UNITS 1 AND 2
DOCKET NUMBERS 50-325 AND 50-324

1.0 INTRODUCTION

By letter dated May 1, 2001, Carolina Power & Light Company (CP&L, the licensee) submitted a license amendment request to use an exemption that would allow CP&L to deviate from complying with the requirements in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix G, for generating the pressure-temperature (P-T) limit curves for the Brunswick Steam Electric Plant, Units 1 and 2 (BSEP). This exemption request would allow CP&L to use ASME Code (Code) Case N-640 as the basis for establishing the fracture toughness values used in P-T limit calculations. Code Case N-640 permits application of the lower bound static initiation fracture toughness value equation (K_{Ic} equation) as the basis for establishing the P-T curves in lieu of using the lower bound crack arrest fracture toughness value equation (i.e., the K_{Ia} equation, the method invoked by Appendix G to Section XI of the ASME Code) as the basis for the curves. Since use of the K_{Ic} equation results in the calculation of less conservative P-T limits than use of the K_{Ia} equation, licensees need staff approval to apply the Code Case methods to the P-T limit calculations.

10 CFR 50.60 requires that all light-water nuclear power reactors must meet the fracture toughness requirements of Appendix G of 10 CFR Part 50. 10 CFR Part 50, Appendix G, requires P-T limit curves to be at least as conservative as limits obtained by following the methods of analysis and the margins of safety of Appendix G of Section XI of the ASME Code. Requests for exemptions to the requirements of 10 CFR Part 50, Appendices G and H, may be submitted pursuant to 10 CFR 50.60(b), which allows licensees to use alternatives to the respective fracture toughness and reactor vessel material surveillance program requirements of the appendices, if an exemption to use the alternatives is granted by the Commission pursuant to 10 CFR 50.12. According to 10 CFR 50.12(a)(1), the Commission may grant exemptions to the requirements of 10 CFR Part 50 if the exemptions are authorized by law, and will not present an undue risk to the public health and safety, and are consistent with the common defense and security.

2.0 LICENSEE EVALUATION

CP&L has requested an exemption to use ASME Code Case N-640 as the basis for establishing the P-T limit curves. Code Case N-640 permits application of the lower bound static initiation fracture toughness value equation (K_{Ic} equation) as the basis for establishing the curves in lieu of using the lower bound crack arrest fracture toughness value equation (i.e., the K_{Ia} equation, which is the method invoked by Appendix G to Section XI of the ASME Code). Use of the K_{Ic} equation in determining the lower bound fracture toughness in the development of the P-T operating limits curves is more technically correct than the use of the K_{Ia} equation since the rate of loading during a heatup or cooldown is slow and is more representative of a static condition than a dynamic condition. The K_{Ic} equation appropriately implements the use of the static initiation fracture toughness behavior to evaluate the controlled heatup and cooldown process of a reactor vessel. The staff has required use of the initial conservatism of the K_{Ia} equation since 1974, when the equation was codified. This initial conservatism was necessary due to the limited knowledge of reactor pressure vessel (RPV) materials. Since 1974, additional knowledge has been gained about RPV materials which demonstrates that the lower bound on fracture toughness provided by the K_{Ia} curve is well beyond the margin of safety required to protect the public health and safety from potential RPV failure.

P-T limits curves based on the K_{Ic} curve will enhance overall plant safety by opening the P-T operating window, especially in the region of low temperature operations. Safety benefits during the pressure test include a reduction in challenges to plant operators in maintaining a high temperature in a limited operating window, personnel safety while conducting inspections in primary containment at elevated temperatures, and increased availability of plant systems, including the Residual Heat Removal system due to the reduction of the heatup and testing time. Based on the above information, CP&L has concluded that the proposed changes to the P-T limits curves will not present an undue risk to the public health and safety.

3.0 STAFF EVALUATION

The staff reviewed the licensee's application regarding the use of ASME Code Case N-640 to permit application of the lower bound static initiation fracture toughness value equation (K_{Ic} equation) as the basis for establishing the P-T curves in lieu of using the lower bound crack arrest fracture toughness value equation (i.e., the K_{Ia} equation, which is based on conditions needed to arrest a dynamically propagating crack, and which is the method invoked by Appendix G to Section XI of the ASME Code). The K_{Ic} equation appropriately implements the use of the static initiation fracture toughness behavior to evaluate the controlled heatup and cooldown process of a reactor vessel. The staff has required use of the initial conservatism of the K_{Ia} equation since 1974, when the equation was codified. This initial conservatism was necessary due to the limited knowledge of RPV materials. Since 1974, additional knowledge has been gained about RPV materials that demonstrates that the lower bound on fracture toughness provided by the K_{Ia} equation is well beyond the margin of safety required to protect the public health and safety from potential RPV failure. In addition, P-T curves based on the K_{Ic} equation will enhance overall plant safety by opening the P-T operating window with the greatest safety benefit in the region of low temperature operations. Thus, pursuant to 10 CFR 50.12(a)(2)(ii), the underlying purpose of the regulation will continue to be served. However, since use of the K_{Ic} equation results in the calculations of less conservative P-T limits than does use of the K_{Ia} equation, licensees need staff approval to apply the Code case methods to the P-T limit calculations.

The staff has determined that CP&L has provided sufficient technical basis for using the methods of Code Case N-640 in the calculation of the P-T limits for BSEP. The staff has also determined that application of Code Case N-640 to the P-T limit calculations will continue to serve the purpose in 10 CFR Part 50, Appendix G, for protecting the structural integrity of the BSEP RPV and reactor coolant pressure boundary. In this case, since strict compliance with the requirements of 10 CFR 50.60(a) and 10 CFR Part 50, Appendix G, is not necessary to serve the overall intent of the regulations, the staff concludes that application of Code Case N-640 to the P-T limit calculations meets the special circumstance provisions in 10 CFR 50.12(a)(2)(ii) for granting exemptions to the regulations, and that, pursuant to 10 CFR 50.12(a)(1), the granting of these exemptions is authorized by law, will not present undue risk to the public health and safety, and is consistent with the common defense and security. The staff therefore grants exemptions to 10 CFR 50.60 and 10 CFR Part 50, Appendix G, to allow CP&L to use Code Case N-640 as the part of the basis for generating the P-T limit curves for BSEP.

4.0 CONCLUSION

The staff has determined that CP&L has provided sufficient technical basis for using the methods of Code Case N-640 in the calculation of the P-T limits for BSEP. The staff concludes that application of Code Case N-640 to the P-T limit calculations meets the special circumstance provisions in 10 CFR 50.12(a)(2)(ii) for granting exemptions to the regulations, and that, pursuant to 10 CFR 50.12(a)(1), the granting of these exemptions is authorized by law, will not present undue risk to the public health and safety, and is consistent with the common defense and security. The staff therefore grants exemptions to 10 CFR 50.60(a) and 10 CFR Part 50, Appendix G, to allow CP&L to use Code Case N-640 as the part of the basis for generating the P-T limit curves for BSEP.

Principal Contributor: E. Andruszkiewicz

Date: October 3, 2001