August 1, 2003

Mr. Mark E. Warner, Site Vice President
c/o James M. Peschel
Seabrook Station
FPL Energy Seabrook, LLC
PO Box 300
Seabrook, NH 03874

SUBJECT: SEABROOK GENERATING STATION, UNIT NO. 1 - EXEMPTION FROM THE REQUIREMENTS OF 10 CFR PART 50, APPENDIX G (TAC NO. MB6699)

Dear Mr. Warner:

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 Seabrook Generating Station, Unit No. 1. This action is in response to your letter of October 11, 2002, that requested exemption from the use of Appendix G in developing revised reactor pressure vessel pressure-temperature (P-T) limits. The P-T limits revision was based, in part, on the use of American Society of Mechanical Engineers Code Case N-641. The use of this code required an exemption from the mandatory use of Appendix G requirements.

On November 1, 2002, the U.S. Nuclear Regulatory Commission (NRC or Commission) approved the transfer of the license for Seabrook Station, to the extent held by North Atlantic Energy Service Corporation (NAESCO), and certain co-owners of the facility, on whose behalf NAESCO was also acting, to FPL Energy Seabrook, LLC (FPLE Seabrook). By letter dated December 20, 2002, FPLE Seabrook requested that the NRC continue to review and act upon all requests before the Commission that had been submitted by NAESCO. Accordingly, we have completed our review of the October 11, 2002, submittal.

A copy of the exemption has been forwarded to the Office of the Federal Register for publication.

Sincerely,

/RA/

Victor Nerses, Senior Project Manager, Section 2
Project Directorate 1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-443

Enclosure: Exemption

cc w/enclosure: See next page

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

FPL ENERGY SEABROOK, LLC

SEABROOK STATION, UNIT 1

DOCKET NO. 50-443

EXEMPTION

1.0 BACKGROUND

At the time that this exemption request was submitted (October 2002), North Atlantic Energy Service Corporation (NAESCO, or the licensee) was the holder of Facility Operating License No. NPF-86 which authorizes operation of the Seabrook Station, Unit No. 1 (Seabrook). The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the U.S. Nuclear Regulatory Commission (NRC, or the Commission) now, or hereafter, in effect.

On November 1, 2002, the Commission approved the transfer of the license for Seabrook, to the extent held by NAESCO, and certain co-owners of the facility, on whose behalf NAESCO was also acting, to FPL Energy Seabrook, LLC (FPLE Seabrook). By letter dated December 20, 2002, FPLE Seabrook requested that the NRC continue to review and act upon all requests before the Commission that had been submitted by NAESCO.

The facility consists of a pressurized water reactor located in Seabrook, New Hampshire.

2.0 REQUEST/ACTION

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.60(a), requires, in part, that except where an exemption is granted by the Commission, all light-water nuclear power reactors must meet the fracture toughness requirements for the reactor coolant pressure boundary set forth in Appendices G and H to 10 CFR Part 50. Appendix G to 10 CFR Part 50 requires that pressure-temperature (P-T) limits be established for reactor pressure vessels (RPVs) during normal operating and hydrostatic or leak rate testing conditions. Specifically, Appendix G to 10 CFR Part 50 states that "The appropriate requirements on both the pressure-temperature limits and minimum permissible temperature must be met for all conditions." Further, Appendix G of 10 CFR Part 50 specifies that the requirements for these limits are based on the application of evaluation procedures given in Appendix G to Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code). The provisions of ASME Code Case N-641 were incorporated in Appendix G of Section XI of the ASME Code in the 1998 Edition through the 2000 Addenda, which is the edition and addenda of record in the 2003 Edition of 10 CFR Part 50. However, in this case, the licensee is still required to request an exemption to apply Code Case N-641 since the Seabrook licensing basis has only been updated to include the 1995 Edition through the 1996 Addenda of the ASME Code.

In order to address provisions of amendments to the Seabrook, Technical Specification (TS) P-T limit curves, FPLE Seabrook requested, in its submittal dated October 11, 2002, that the staff exempt Seabrook from application of specific requirements of Appendix G to 10 CFR Part 50, and substitute use of ASME Code Case N-641. ASME Code Case N-641 permits the use of an alternate reference fracture toughness curve (i.e., use of "K_{IC} fracture toughness curve" instead of "K_{IA} fracture toughness curve," where K_{IC} and K_{IA} are "Reference Stress Intensity Factors," as defined in ASME Code, Section XI, Appendices A and G,

respectively) for RPV materials and permits the postulation of a circumferentially-oriented flaw for the evaluation of circumferential RPV welds when determining the P-T limits. The proposed exemption request is consistent with, and is needed to support, the Seabrook TS amendment that was contained in the same submittal. The proposed Seabrook TS amendment will revise the P-T limits for heatup, cooldown, and inservice test limitations for the reactor coolant system (RCS) through 20 effective full-power years of operation.

Code Case N-641

The licensee has proposed an exemption to allow use of ASME Code Case N-641 in conjunction with Appendix G to ASME Section XI, 10 CFR 50.60(a) and 10 CFR Part 50, Appendix G, to establish the P-T limits for the Seabrook RPV.

The proposed TS amendment to revise the P-T limits for Seabrook relies, in part, on the requested exemption. These revised P-T limits have been developed using the lower-bound K_{Ic} fracture toughness curve shown in ASME Section XI, Appendix A, Figure A-2200-1, in lieu of the lower-bound K_{Ia} fracture toughness curve of ASME Section XI, Appendix G, Figure G-2210-1, as the basis fracture toughness curve for defining the Seabrook P-T limits. In addition, the revised P-T limits have been developed based on the use of a postulated circumferentially-oriented flaw for the evaluation of RPV circumferential welds, in lieu of the axially-oriented flaw which would be required by Appendix G to Section XI of the ASME Code. The other margins involved with the ASME Section XI, Appendix G process of determining P-T limit curves remain unchanged.

Use of the K_{Ic} curve as the basis fracture toughness curve for the development of P-T operating limits is more technically correct than use of the K_{Ia} curve. The K_{Ic} curve appropriately implements the use of a relationship based on static initiation fracture toughness behavior to evaluate the controlled heatup and cooldown process of a RPV, whereas the K_{Ia} fracture toughness curve codified into Appendix G to Section XI of the ASME Code was

developed from more conservative crack arrest and dynamic fracture toughness test data. The application of the K_{Ia} fracture toughness curve was initially codified in Appendix G to Section XI of the ASME Code in 1974 to provide a conservative representation of RPV material fracture toughness. This initial conservatism was necessary due to the limited knowledge of RPV material behavior in 1974. However, additional knowledge has been gained about RPV materials which demonstrates that the lower bound on fracture toughness provided by the K_{Ia} fracture toughness curve is well beyond the margin of safety required to protect the public health and safety from potential RPV failure.

Likewise, the use of a postulated circumferentially-oriented flaw in lieu of an axially-oriented one for the evaluation of a circumferential RPV weld is more technically correct. The size of a flaw required to be postulated for P-T limit determination has a depth of one-quarter of the RPV wall thickness and a length six-times the depth. Based on the direction of welding during the fabrication process, the only technically-reasonable orientation for such a large flaw is for the plane of the flaw to be circumferentially-oriented (i.e., parallel to the direction of welding). Prior to the development of ASME Code Case N-641 (and the similar ASME Code Case N-588), the required postulation of an axially-oriented flaw for the evaluation of a circumferential RPV weld has provided an additional and unnecessary level of conservatism to the overall evaluation.

In addition, P-T limit curves based on the K_{Ic} fracture toughness curve and postulation of a circumferentially-oriented flaw for the evaluation of RPV circumferential welds will enhance overall plant safety by opening the P-T operating window with the greatest safety benefit in the region of low temperature operations. The operating window through which the operator heats up and cools down the RCS is determined by the difference between the maximum allowable pressure defined by Appendix G of ASME Section XI, and the minimum required pressure for the reactor coolant pump seals adjusted for instrument uncertainties. A narrow operating

window could potentially have an adverse safety impact by increasing the possibility of inadvertent overpressure protection system actuation due to pressure surges associated with normal plant evolutions such as RCS pump starts and swapping operating charging pumps with the RCS in a water-solid condition.

Since application of ASME Code Case N-641 provides appropriate procedures to establish maximum postulated defects and to evaluate those defects in the context of establishing RPV P-T limits, this application of the Code Case maintains an adequate margin of safety for protecting RPV materials from brittle failure. Therefore, the licensee concluded that these considerations were special circumstances pursuant to 10 CFR 50.12(a)(2)(ii), which states: "Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule."

In summary, the ASME Section XI, Appendix G procedure was conservatively developed based on the level of knowledge existing in 1974 concerning reactor coolant pressure boundary materials and the estimated effects of operation. Since 1974, the level of knowledge about the fracture mechanics behavior of RCS materials has been greatly expanded, especially regarding the effects of radiation embrittlement and the understanding of fracture toughness properties under static and dynamic loading conditions. The NRC staff concurs that this increased knowledge permits relaxation of the ASME Section XI, Appendix G requirements by application of ASME Code Case N-641, while maintaining, pursuant to 10 CFR 50.12(a)(2)(ii), the underlying purpose of the ASME Code and the NRC regulations to ensure an acceptable margin of safety against brittle failure of the RPV.

The NRC staff has reviewed the exemption request submitted by FPLE Seabrook and has concluded that an exemption should be granted to permit the licensee to utilize the

provisions of ASME Code Case N-641 for the purpose of developing Seabrook RPV P-T limit curves.

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.

Special circumstances, pursuant to 10 CFR 50.12(a)(2)(ii), are present in that continued operation of Seabrook with the P-T limit curves developed in accordance with ASME Section XI, Appendix G without the relief provided by ASME Code Case N-641 is not necessary to achieve the underlying purpose of Appendix G to 10 CFR Part 50. Application of ASME Code Case N-641 in lieu of the requirements of ASME Code Section XI, Appendix G provides an acceptable alternative methodology which will continue to meet the underlying purpose of Appendix G to 10 CFR Part 50. The underlying purpose of the regulations in Appendix G to 10 CFR Part 50 is to provide an acceptable margin of safety against brittle failure of the RCS during any condition of normal operation to which the pressure boundary may be subjected over its service lifetime.

The staff examined the licensee's rationale to support the exemption request, and concluded that the use of ASME Code Case N-641 would satisfy 10 CFR Part 50, Section 50.12(a)(1) as follows:

1) The requested exemption is authorized by law:

No law exists which precludes the activities covered by this exemption request. The regulation 10 CFR Part 50, Section 50.60(b), allows the use of

alternatives to 10 CFR Part 50, Appendices G and H, when an exemption is granted by the Commission pursuant to 10 CFR Part 50, Section 50.12.

2) The requested exemption does not present an undue risk to the public health and safety:

ASME Code Case N-641 permits the use of alternate reference fracture toughness (K_{IC} fracture toughness curve instead of K_{IA} fracture toughness curve) for RPV Materials in determining the P-T limits. The use of the K_{IC} curve provides greater allowable fracture toughness than the corresponding K_{IA} curve. The other margins involved with the ASME Code, Section XI, Appendix G process of determining P-T limit curves remain unchanged.

Use of the K_{IC} curve in determining the lower-bound fracture toughness, which is, in turn, used in the development of the P-T operating limits curve, models the slow heatup and cooldown process of a reactor vessel. The K_{IC} curve appropriately implements the use of static initiation fracture toughness behavior to evaluate the controlled heatup and cooldown process of a RPV.

Use of this approach is justified by the initial conservatism of the K_{IA} curve when it was codified in 1974. This initial conservatism was necessary due to limited knowledge of RPV material fracture toughness. Since 1974, additional knowledge has been gained about the fracture toughness of vessel materials and their fracture response to applied loads. The additional knowledge demonstrates that the lower-bound fracture toughness provided by the K_{IA} curve is well beyond the margin of safety required to protect against potential RPV failure. The lower-bound K_{IC} fracture toughness provides an adequate margin of safety to protect against potential RPV failure and does not present an undue risk to public health and safety.

3) The requested exemption will not endanger the common defense and security:

The common defense and security are not affected and, therefore, not endangered by this exemption.

Based upon a consideration of the conservatism that is explicitly incorporated into the methodologies of Appendix G to 10 CFR Part 50; Appendix G to Section XI of the ASME Code; and Regulatory Guide 1.99, Revision 2; the staff concluded that application of ASME Code Case N-641, as described, would provide an adequate margin of safety against brittle failure of the RPV. Therefore, the staff concludes that pursuant to 10 CFR 50.12(a)(1), an exemption from the requirements of 10 CFR Part 50, Appendix G is appropriate, and that the methodology of Code Case N-641 may be used to revise the P-T limits for the Seabrook RPV.

4.0 CONCLUSION

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants FPL Energy Seabrook, LLC an exemption from the requirements of 10 CFR 50.60(a) and 10 CFR Part 50, Appendix G, to allow application of ASME Code Case N-641 in establishing TS requirements for the reactor vessel pressure limits at low temperatures for Seabrook.

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 (68 FR 44109).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 1st day of August, 2003.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Ledyard B. Marsh, Director
Division of Licensing Project Management
Office of Nuclear Reactor Regulation