September 11, 2003

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

SUBJECT: SEABROOK STATION, UNIT NO. 1 - ISSUANCE OF AMENDMENT RE: CHANGES TO TECHNICAL SPECIFICATIONS ASSOCIATED WITH PRESSURE/TEMPERATURE LIMITS AND OVERPRESSURE PROTECTION SYSTEMS (TAC NO. MB6613)

Dear Mr. Warner:

The U.S. Nuclear Regulatory Commission (NRC or the Commission) has issued the enclosed Amendment No. 89 to Facility Operating License No. NPF-86 for the Seabrook Station, Unit No. 1, in response to your application dated October 11, 2002, as supplemented by letter dated May 29, 2003, filed by North Atlantic Energy Service Corporation (NAESCO) as the then licensee for Seabrook Station, Unit No. 1. On November 1, 2002, the NRC approved the transfer of the license for Seabrook Station, 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 amendment revises Technical Specification (TS) 3.4.9.1, “Reactor Coolant System [RCS]-Pressure/Temperature Limits,” and TS 3.4.9.3, “Reactor Coolant System - Overpressure Protection Systems,” and their associated Bases sections. Specifically, the changes replace TS Figures 3.4-2 “Reactor Coolant System Heatup Limitations,” 3.4-3 “Reactor Coolant System Cooldown Limitations,” and 3.4-4 “RCS Cold Overpressure Protection,” to allow operation to 20 Effective Full-Power Years.

The change also revises TS 3.4.9.3, Cold Overpressure Protection System, arming temperature from 329 ^{o}F to 290 ^{o}F. This change reflects the use of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code Case N-641.

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

Sincerely,

/RA/

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

Docket No. 50-443

Enclosures: 1. Amendment No. 89 to NPF-86
2. Safety Evaluation

cc w/encls: See next page

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Sincerely,

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Victor Nerses, Senior Project Manager, Section 2
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FPL ENERGY SEABROOK, LLC, ET AL.*

DOCKET NO. 50-443

SEABROOK STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 89
License No. NPF-86

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

   A. The application for amendment filed by the FPL Energy Seabrook, LLC, et al. (the licensee), dated October 11, 2002, as supplemented May 29, 2003, 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.

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*FPL Energy Seabrook, LLC (FPLE Seabrook), is authorized to act as agent for the: Hudson Light & Power Department, Massachusetts Municipal Wholesale Electric Company, and Taunton Municipal Light Plant and has exclusive responsibility and control over the physical construction, operation and maintenance of the facility.

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-86 is hereby amended to read as follows:

   (2) Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 89, and the Environmental Protection Plan contained in Appendix B are incorporated into Facility License No. NPF-86. FPLE Seabrook 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 issuance.

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 11, 2003

ATTACHMENT TO LICENSE AMENDMENT NO. 89

FACILITY OPERATING LICENSE NO. NPF-86

DOCKET NO. 50-443

Replace the following pages of the Appendix A, Technical Specifications, with the attached revised pages as indicated. The revised pages are identified by amendment number and contain marginal lines indicating the area of change.

Remove	Insert
vi	vi
x	x
xi	xi
3/4 4-31	3/4 4-31
3/4 4-32	3/4 3-32
3/4 4-34	3/4 4-34
3/4 4-36	3/4 4-36
B 3/4 4-7	B 3/4 4-7
B 3/4 4-8	B 3/4 4-8
B 3/4 4-9	B 3/4 4-9
B 3/4 4-11	B 3/4 4-11
B 3/4 4-12	B 3/4 4-12
B 3/4 4-13	B 3/4 4-13
B 3/4 4-14	B 3/4 4-14
----------	B 3/4 4-14a
B 3/4 4-15	B 3/4 4-15

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 89 TO FACILITY OPERATING LICENSE NO. NPF-86

FPL ENERGY SEABROOK, LLC

SEABROOK STATION, UNIT NO. 1

DOCKET NO. 50-443

1.0 INTRODUCTION

By letter dated October 11, 2002, the North Atlantic Energy Service Corporation (NAESCO), as the then licensee for Seabrook Station, Unit No.1 (Seabrook), submitted information and requested Technical Specification (TS) changes to implement a revision of the pressure-temperature (P-T) curves and the low-temperature overpresure protection (LTOP) limits. On November 1, 2002, the U.S. Nuclear Regulatory Commission (NRC or 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 or licensee). 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. Additional information was submitted in the licensee's supplemental letter dated May 29, 2003. The May 29, 2003, letter clarified the application, did not expand the scope of the application as originally noticed, and did not change the staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on December 10, 2002 (67 FR 75879).

The licensee requested approval to revise the P-T curves and LTOP limits for use to 20 effective full power years of operation (EFPYs). The revision also includes an exemption request to apply the American Society of Mechanical Engineers Boiler and Pressure Vessel Code Case (ASME Code) N-641.

The purpose of this review is to evaluate: (1) the methodology used for the vessel fluence calculation to revise the P-T curves; (2) the limiting adjusted reference temperature to be used in determining the P-T curves; (3) the P-T curves for compliance with 10 CFR Part 50, Appendix G, as modified by Code Case N-641; and (4) the method used for the estimation of the LTOP limits.

2.0 REGULATORY EVALUATION

2.1 General Design Criteria (GDC) 30 and 31

The regulatory requirements for neutron fluence calculations are established in GDC 30 and GDC 31. In March 2001, the staff issued Regulatory Guide (RG) 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence." Methodologies which adhere to the guidance in RG 1.190, satisfy the requirements of GDC 30 and 31. Fluence

calculations are acceptable if they are done with approved methodologies or with methods which are shown to conform to the guidance in RG 1.190.

The methodology for the calculation of the P-T curves and the LTOP limits is presented in WCAP-14040NP-A, which the staff has approved by letter dated October 16, 1995. In this report, the LTOP is referred to as the cold overpressure mitigating system (COMS). COMS is enabled at a predetermined temperature to prevent the reactor coolant system (RCS) pressure from exceeding the applicable limits as established in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix G. To relieve potential overpressurization, COMS uses the pressurizer power- operated relief valves (PORVs). The setpoint calculation analysis considers mass and energy injection transients.

2.2 Appendix G to 10 CFR Part 50

The NRC has established requirements in 10 CFR Part 50, Appendix G, to protect the integrity of the reactor coolant pressure boundary in nuclear power plants. Appendix G of 10 CFR Part 50, requires that the P-T limits for an operating light-water reactor be at least as conservative as those that would be generated if the methods of Appendix G to Section XI of the ASME Code (henceforth referred to as Appendix G to Section XI) were used to generate the P-T limits. Table 1 of 10 CFR Part 50, Appendix G provides the criteria for meeting the P-T limit requirements of Appendix G to Section XI as well as the minimum temperature requirements for bolting up the vessel during normal and pressure testing operations.

The basic parameter used in Appendix G to Section XI for calculating P-T limit curves is the stress intensity factor (K_I factor), which is a function of the stress state at the crack-tip and flaw configuration. The methods of Appendix G to Section XI require, in part, that licensees calculate the maximum allowable K_I factors and pressures for the Reactor Pressure Vessel (RPV) as a function of temperature. This function is based on use of the lower bound crack arrest fracture toughness equation (K_{IA} equation) for the limiting adjusted reference temperature value (RT_{NDT}). RG 1.99, Revision 2, provides an acceptable method of calculating the limiting adjusted RT_{NDT} values for ferritic RPV materials. RG 1.99, Revision 2, includes methods for adjusting the RT_{NDT} values 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.

2.3 Exemptions to the Requirements of 10 CFR Part 50, Appendix G

In their license amendment request, dated October 11, 2002, FPLE Seabrook requested NRC approval of an exemption to use ASME Code Case N-641 as an alternative to the specific requirements in 10 CFR Part 50, Appendix G, for generating the P-T limit curves. Pursuant to 10 CFR 50.60(b), licensees may use alternatives to the requirements of 10 CFR Part 50, Appendix G, if an exemption to use alternatives is granted by the Commission pursuant to 10 CFR 50.12. By letter dated August 1, 2003, the Commission approved the requested exemption to use Code Case N-641 in the development of the P-T limit curves.

3.0 TECHNICAL EVALUATION

3.1 Fluence Methodology Evaluation

The neutron flux calculation, as used in Reference 2, is based on the discrete ordinates method in the DORT code, using the BUGLE-96 cross-section library. Anisotropic scattering is represented by a P_3 expansion of the scattering cross-section, and the angular discretization by an S_8 angular quadrature. Each of the five cycles was run separately with its own absolute value neutron source, derived from a pin-wise fuel distribution. Because each cycle was calculated separately, adjoint calculations were not required. The licensee performed a detailed uncertainty analysis for dosimetry. The staff reviewed the licensee's analysis with respect to (1) determination of the geometrical and material input data, (2) determination of the core neutron source, (3) propagation of the neutron fluence from the core to the vessel and into the cavity, and (4) qualification of the calculational procedure and found that it is consistent with RG 1.190 and is, therefore, acceptable because it satisfies the requirements of GDC 14, 30 and 31.

3.2 Dosimetry Results

Comparisons of calculated-to-measured (C/M) dosimeter activations are tabulated in Reference 2. The staff reviewed the C/M dosimeter activations and found that they showed very good agreement. The average C/M value for capsule Y for the major dosimeters (i.e. the Fe, Ni, and Cu dosimeters) is within 10% with a standard deviation of .038. The licensee also presented the results from the Seabrook surveillance capsule U, which was removed from azimuthal position 31.5° at the end of the first cycle with an accumulated irradiation of .913 EFPYs. The Fe/Ni/Cu average C/M value is within 3%, with a standard deviation of .050. Finally, the licensee presented the results for capsules U, Y and V from the Callaway, Unit No. 1 (a sister plant to Seabrook). The staff found that the Callaway results are very similar to the Seabrook results. The similarity of the Callaway results combined with the good agreement of the C/M values support a high degree of confidence in the Seabrook dosimetry and the fluence methodology used for Seabrook.

3.3 P-T Curves

The licensing basis for the P-T limit curves at Seabrook, as given in the TSs, include two figures:

- TS Figure 3.4-2, which provides the P-T limit curves for normal operations of the reactor, including heatups at 100 °F/hr, operations with the core critical, leak test operations, and requirements for minimum boltup temperatures.

- TS Figure 3.4-3, which provides the P-T limit curves for normal cooldown operations of the reactor at cooldown rates of 0 °F/hr (i.e., steady state), 20 °F/hr, 40 °F/hr, 60 °F/hr, 80 °F/hr, and 100 °F/hr.

Appendix G, Section (IV)(A)(2) of 10 CFR Part 50 requires the P-T limit curves to be at least as conservative as if the methods and criteria in Appendix G to Section XI were used to generate the P-T limit curves. The new P-T limit curves (i.e., the new unirradiated beltline P-T limit curves, and new P-T limit curves for the region of the Reactor Vessel remote to the beltline) in

TS Figures 3.4.2, 3.4.3, and 3.4.4 are based on use of ASME Code Case N-641 and the lower bound static initiation fracture toughness value equation (K_{IC} equation) given in Paragraph G2110 of the 2001 Edition of Appendix G to Section XI. Code Case N-461 permits application of the K_{IC} equation as the basis for establishing the P-T limit curves in lieu of using the K_{IA} equation invoked by the 1995 edition of Appendix G to Section XI, which is the Code Edition of record for Seabrook. The 2001 Edition of Appendix G to Section XI is not currently endorsed in 10 CF 50.55a and the use of Code Case N-641 results in the development of P-T limit curves that are less conservative than would be generated using the methods of Appendix G to Section XI. Given this, licensees must be granted an exemption to use the Code Case. By letter dated August 1, 2003, the staff approved an exemption permitting use of the ASME Code Case N-641 methods for the generation of the Seabrook P-T limit curves.

To ensure that the new irradiated P-T limit curves for Seabrook would still comply with the intent of 10 CFR Part 50, Appendix G, Section (IV)(A)(2), the staff requested FPLE Seabrook to provide additional P-T limit thermal stress intensity data for the Seabrook Reactor Vessel effective to 20 EFPYs. The licensee provided this information by letter dated May 29, 2003. In order to verify compliance with Section (IV)(A)(2), as modified by Code Case N-641, the staff performed an independent assessment of the irradiated P-T limit data for heatups and cooldowns of the reactor at heatup/cooldown rates of 100 °F/hr.

The staff confirmed that the limiting material (Plate R1808-1) had 109 °F and 88 °F as the 1/4T and 3/4 RT_{NDT} input values, respectively, for the generation of the irradiated P-T limit curves effective to 20 EFPYs. The RT_{NDT} values were calculated in accordance with the guidance of RG 1.99, Revision 2.

The staff also confirmed that the proposed irradiated P-T limit curves that were generated by the licensee were at least as conservative as those that would be generated if the criteria and methods in the 1995 Edition of Appendix G to Section XI, as modified by the use of ASME Code Case N-641, were used. Further, the staff confirmed that FPLE Seabrook's P-T limits curves included appropriate minimum temperature requirements that were at least as conservative as those required in Table 1 of 10 CFR Part 50, Appendix G. The heatup and cooldown curves for normal operation are reported in WCAP-15745. The methodology used is consistent with WCAP-14040-NP-A, and the fluence values were obtained from the Framatome report DES-NFQA-98-01. The staff had previously approved both the fluence and the P-T curve calculational methodologies.

The staff finds that the licensee has developed the proposed P-T limits in accordance with the requirements of 10 CFR Appendix G, as modified by Code Case N-641, and that an independent verification provided confirmation of proper P-T limit curve calculation. Given this consideration, the staff finds that the new P-T limit curves will provide adequate protection of public health and safety.

3.4 LTOP Methodology

The COMS provides LTOP in Seabrook using the PORVs and reduced pressure setpoints. The derivation of the LTOP setpoints for 20 EFPYs of operation satisfies the requirements in Appendix G to 10 CFR Part 50, and the ASME Code Case N-641. The method, the assumptions, and the calculations are described in the Framatome report NFSB 02-0061.

To determine the PORV setpoints, the Framatome report considers two design basis overpressure events, the heat-addition and the mass-addition transients. For the heat addition transient, the report assumes that the steam generators are 50 °F hotter than the vessel water with the reactor coolant pumps (RCPs) not running. An inadvertent start of an RCP will inject higher temperature water into the vessel. To calculate the peak pressure, the report conservatively assumes that the temperature of the vessel water inventory will be raised by 50 °F. The PORV setpoint at the initial RCS temperature plus 50 °F is sufficiently low to preclude violation of the LTOP pressure limit (at the initial temperature) including consideration of the maximum pressure overshoot.

The mass addition transient analyzed in the Framatome report is water injection from one centrifugal charging pump. The PORVs are sized such that one is able to discharge the flow from one centrifugal charging pump. The report assumes that letdown flow is isolated. The plant TSs allow simultaneous operation of two centrifugal charging pumps. Plant operating procedures prevent accidental injection by two pumps. The TSs limit this condition to about one hour in Modes 4 and 5, and to one hour when entering or exiting Mode 3. The TSs permit the operation of two charging pumps under LTOP conditions for a one-hour period while under administrative control, except during RCS water solid operations for charging pump-swap operations. The NRC staff approved Seabrook license Amendment No. 74 on the basis that this operation continues to meet Appendix G. This is similar to the Technical Specification Task Force 285, which has also been approved by the staff. The staff determined that such operation can be allowed since overpressurization is unlikely while the plant is under administrative control for a short period of time. The staff finds the proposal acceptable because it continues to meet Appendix G to 10 CFR Part 50.

The PORV setpoint is lower than the LTOP pressure limit by the predicted pressure overshoot and allows for instrument uncertainty. The pressure overshoot determines (for both mass and energy addition transients) the maximum allowable PORV setpoint to prevent violating the LTOP pressure limit, thereby protecting the integrity of the RCS pressure boundary.

3.5 Summary and Conclusion

The staff reviewed the information submitted by FPLE Seabrook to support TS changes related to a revision of the P-T curves and the LTOP limits to be applicable to 20 EFPYs. Specifically, the staff reviewed the vessel fluence methodology and the peak transient-pressure methodology for the estimation of the LTOP pressure setpoints and enable temperature. Additionally the staff performed an independent confirmation that the calculational methods used by FPLE Seabrook to generate their P-T limits satisfy the requirements of 10 CFR Part 50, Appendix G, as modified by the criteria and methods in ASME Code Case N-641. Based on this review and verification, which is provided above, the staff concluded that: (1) the methodology used for the calculation of the vessel fluence conforms to the guidance in RG 1.190; (2) the method used to calculate the P-T curves conforms to WCAP-14040-NP-A, and is in accordance with 10 CFR Part 50, Appendix G (as modified by the criteria and methods in ASME Code Case N-641); and (3) the methodology used to calculate the LTOP setpoint satisfies the requirements of Appendix G to 10 CFR Part 50 (as modified by the criteria and methods in ASME Code Case N-641) and, therefore, all are acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the New Hampshire and Massachusetts State officials were notified of the proposed issuance of the amendment. The State officials 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 (67 FR 75879). 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.

7.0 REFERENCES

1. Letter from J.M. Vargas, North Atlantic Energy Service Corporation, to US NRC, "Revision to Technical Specifications Associated with Pressure/Temperature Curves and Low Temperature Overpressure Protection Limits," October 11, 2002.

2. Letter from M.E. Warner, FPL Energy Seabrook Station, to US NRC, "Response to Request for Additional Information for Licensing Amendment Request 02-04, Revision to Technical Specifications Associated with Pressure/Temperature Curves and Low Temperature Overpressure Protection Limits," May 29, 2003.

3. DES-NFQA-98-01, "Analysis of Seabrook Station Unit 1 Reactor Vessel Surveillance Capsules U and Y," by E.C. Biemiller and G.M. Solan, Duke Engineering and Services, Bolton, MA, May 1998.

4. WCAP-15745, "Seabrook Unit 1 Heatup and Cooldown Limit Curves for Normal Operations," by T.J. Laubham, Westinghouse Electric Company, LLC, December 2001.

5. Regulatory Guide 1.190, "Calculational and Dosimetry Methods for Determining Pressure Vessel Neutron Fluence," NRC, March 2001.

6. WCAP-14040-NP-A, Revision 2, “Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves,” January 1996.

7. TORT-DORT Two- and Three-Dimensional Discrete Ordinates Transport, Version 2.8.14, Radiation Shielding Information Center, Computer Code Collection CCC-543, Oak Ridge National Laboratory, Oak Ridge, Tennessee, June 1994.

8. BUGLE-96, Coupled 47 Neutron, 20 Gamma-Ray Group Cross Section Library Derived from ENDF/B-VI for LWR Shielding and Pressure Vessel Dosimetry Applications, Radiation Shielding Information Center, Data Library Collection DLC-185, Oak Ridge National Laboratory, Oak Ridge Tennessee, March 1996.

9. NFSB 02-0061, “Seabrook Station Cold Overpressure Mitigating System (COMS) Setpoint Development Methodology,” by P.J. Guimond, Framatome, August 2002.

10. Regulatory Guide 1.99, “Radiation Embrittlement of Reactor Vessel Materials,” NRC, May 1988.

11. American Society of Mechanical Engineers, Code Case N-641.

Principal Contributors: L. Lois
M. Khanna

Date: September 11, 2003