North Atlantic

SEABROOK STATION UNIT 1

Facility Operating License NPF-86
Docket No. 50-443

License Amendment Request No. 95-05
Positive Moderator Temperature Coefficient

This License Amendment Request is submitted by North Atlantic Energy Service Corporation pursuant to 10CFR50.90. The following information is enclosed in support of this License Amendment Request:

- **Section I - Introduction and Safety Evaluation for the Proposed Changes**
- **Section II - Markup of Proposed Changes**
- **Section III - Retype of Proposed Changes**
- **Section IV - Determination of Significant Hazards for License Amendment Request 95-05 Proposed Changes**
- **Section V - Proposed Schedule for License Amendment Issuance and Effectiveness**
- **Section VI - Environmental Impact Assessment**

Sworn and Subscribed
to before me this
31 day of May, 1995

Marilyn A. Sullivan
Notary Public

Bruce L. Drawbridge
Executive Director - Nuclear Production

I. INTRODUCTION AND SAFETY EVALUATION OF PROPOSED CHANGES

A. Introduction

The purpose of License Amendment Request (LAR) 95-05 is to propose changes to the Seabrook Station Technical Specifications to allow operation of the core with a positive moderator temperature coefficient (PMTC) at low power. Technical Specification 3.1.1.3 currently requires the moderator temperature coefficient (MTC) to be within the limits specified in the COLR with a maximum upper limit of 0 $\Delta k/k/^{\circ}F$ at all power levels. The implementation of this change will provide significant improvement in fuel utilization by reducing the amount of burnable neutron absorber required to control core reactivity. This reduction will result in a savings of approximately $800,000 per operating cycle. Therefore, North Atlantic has determined that LAR 95-05 qualifies as a Cost Beneficial Licensing Action (CBLA) as defined in NRC Administrative Letter 95-02.

In LAR 93-18[1], North Atlantic proposed a PMTC for Seabrook Station. The proposed change to the Technical Specifications followed the example of other Westinghouse PWRs which were already licensed with a PMTC. LAR 93-18 included supporting material, i.e. YAEC-1871[2], which referenced a Westinghouse topical report, WCAP-11993[3], as a basis for demonstrating compliance with the risk goal of the ATWS Rule[4] while operating with a PMTC. Concurrent with the approval[5] of LAR 93-18, the NRC stated that WCAP-11993 had not been reviewed and therefore could not be used as a basis for supporting a Technical Specification change to include operation with a PMTC. LAR 93-18 has been approved and License Amendment No. 33 was issued[5,6] without the proposed change to a PMTC. With the exception of the section which demonstrates compliance with the ATWS Rule, the safety analysis in YAEC-1871 with its approval in License Amendment No. 33 provides assurance that Seabrook Station can be safely operated with a PMTC.

LAR 95-05 renews the previously proposed (LAR 93-18) change to Technical Specification 3.1.1.3 to allow a maximum upper MTC limit of $+0.5 \times 10^{-4}$ $\Delta k/k/^{\circ}F$ with all rods withdrawn, beginning of cycle (BOC), for power levels up to 70% rated thermal power with a linear ramp to 0 $\Delta k/k/^{\circ}F$ at 100% rated thermal power. However, additional changes to the Basis for Technical Specification 3.1.1.3 identify a commitment to compliance with the ATWS Rule and the basis for the Rule by assuring that the ATWS core damage frequency is below the target of 1.0×10^{-5} per reactor year established in SECY-83-293[7]. This is achieved by determining a more restrictive cycle specific upper MTC limit which ensures compliance with the ATWS Rule and placing the MTC limit in the COLR. A cycle specific upper MTC limit will be determined using a proposed analytical method identified by reference in Technical Specification 6.8.1.6.b., Administrative Controls. The proposed method is described below.

In 1979, Westinghouse submitted two letter reports [8,9] on generic ATWS analysis and sensitivity studies to the NRC. ATWS analyses were performed with a 95% MTC (-8 pcm/°F). Actual MTC values were determined to be more negative than this value 95% of the time for all Westinghouse plants. Results showed that the calculated peak Reactor Coolant System (RCS) pressure remained within acceptance criteria during a postulated limiting ATWS event. The analysis results were used in the formulation of the final ATWS Rule. The 1979 analysis and sensitivity studies were previously reviewed to ensure their applicability to Seabrook Station. This review included consideration of plant specific design features. The conclusion of the review was that peak RCS pressure during a postulated limiting ATWS event would remain within acceptance criteria, i.e. no reactor vessel failure. This conclusion is true provided the MTC is more negative than

-8 pcm/°F 95% of the time. Cycles can be designed such that the MTC remains within the limits of Technical Specification 3.1.1.3 as well as remaining more negative than -8 pcm/°F 95% of the time.

The methodology proposed above is very similar to that used by Kewaunee to demonstrate the acceptability of a PMTC, which the NRC issued as Amendment 117 to Operating License DPR #043 on April 3, 1995.

This section describes the proposed changes to the Facility Operating License to allow operation with a positive moderator temperature coefficient (PMTC) at low power. In summary, the proposed changes affect:

1) Technical Specification 3.1.1.3, Moderator Temperature Coefficient;
2) the Basis to Technical Specification 3.1.1.3;
3) Technical Specification 6.8.1.6.b, Administrative Controls; and
4) the Core Operating Limits Report (COLR).

A detailed description of each proposed change is provided below.

1. Technical Specification 3.1.1.3, Moderator Temperature Coefficient

Technical Specification 3.1.1.3 states that the MTC shall be within the limits specified in the COLR and the maximum upper limit shall be less positive than 0 $\Delta k/k/°F$. The maximum upper limit is changed to $+0.5 \times 10^{-4}$ $\Delta k/k/°F$ for all rods out (ARO), BOC for power levels up to 70% Rated Thermal Power with a linear ramp to 0 $\Delta k/k/°F$ at 100% Rated Thermal Power. This follows the example of other Westinghouse PWRs which are currently licensed with a PMTC and the change is supported by the safety analysis documented in YAEC-1871[2] approved in License Amendment No. 33[5,6].

2. Basis to Technical Specification 3.1.1.3

A paragraph is added to the Basis to Technical Specification 3.1.1.3 which states a commitment to compliance with the ATWS Rule and the basis for the Rule by assuring ATWS core damage frequency will remain below the target of 1.0×10^{-5} per reactor year established in SECY-83-293[7]. This is achieved by determining a more restrictive cycle specific upper MTC limit which assures compliance with the ATWS Rule and placing it in the COLR.

3. Technical Specification 6.8.1.6.b, Administrative Controls

Technical Specification 6.8.1.6.b lists the analytical methods used to determine the core operating limits. The analytical method used to determine the cycle specific upper MTC limit placed in the COLR which assures compliance with the ATWS Rule is discussed in this LAR. A reference is added to Technical Specification 6.8.1.6.b.

4. Core Operating Limits Report

The COLR currently identifies the following cycle specific upper MTC limit:

> ***The Moderator Temperature Coefficient (MTC) shall be less positive than 0 Δk/k/°F for Beginning of Cycle Life (BOL), All Rods Out (ARO), Hot Zero Thermal Power Conditions.***

Upon approval of this LAR, the cycle specific upper MTC limit will be changed to the value determined using the analytical method described herein. Typical MTC values with ARO, BOC are shown in Figure 1. Using the example of the typical core illustrated in Figure 2, the above COLR limit would be changed to:

> ***The Moderator Temperature Coefficient (MTC) shall be less positive than + 0.23 x 10^{-4} Δk/k/°F for Beginning of Cycle Life (BOL), All Rods Out (ARO), Hot Zero Thermal Power Conditions.***

This assures that operation with a PMTC will proceed in compliance with the risk goal of the ATWS Rule by limiting the MTC to the value assumed in supporting generic analysis[8,9].

B. Safety Evaluation of Proposed Changes

Technical Specification 3.1.1.3 is modified to specify a maximum upper MTC limit of $+0.5 \times 10^{-4}$ Δk/k/°F for all rods withdrawn, beginning of cycle (BOC), for power levels up to 70% rated thermal power with a linear ramp to 0 Δk/k/°F at 100% rated thermal power. The safety analysis in YAEC-1871[2] with its approval in License Amendment No. 33[5,6] provides assurance that Seabrook Station can be safely operated up to this proposed limit.

Changes to the Basis for Technical Specification 3.1.1.3 identify a commitment to compliance with the ATWS Rule and the basis for the Rule by assuring ATWS core damage frequency remains below the target of 1.0×10^{-5} per reactor year established in SECY-83-293[7]. This is achieved by determining a more restrictive cycle specific upper MTC limit which assures compliance with the ATWS Rule and placing it in the COLR. A cycle specific upper MTC limit will be determined using a proposed analytical method identified by reference in Technical Specification 6.8.1.6.b., Administrative Controls. The proposed analytical method is described in Section I.A of this LAR.

The least negative MTC values for a typical cycle occur with all control rods out (ARO) near beginning of cycle (BOC) conditions as illustrated in Figure 1. Figure 2 illustrates the least negative MTC near BOC as a function of thermal power level for a typical cycle. Figure 2 also illustrates the effect of designing a cycle with the least negative MTC limited to -8 pcm/°F at hot full power (HFP), ARO. This is accomplished by adjusting the amount of burnable neutron absorber and, therefore, the critical boron concentration. The behavior of MTC with cycle exposure and power level is such that for cycles designed with a limit of -8 pcm/°F at HFP, ARO, there will be times when the MTC is less negative. The power history of previous cycles at Seabrook Station was reviewed. The review involved determining the duration of periods when the reactor was critical but at less than full power. Assuming cycles were designed with a limit of -8 pcm/°F at HFP, ARO, the total fraction of time when the MTC would have been less negative was determined. The conclusion is that the MTC of previous cycles designed with a

limit of -8 pcm/°F ARO, HFP would be less negative for less than 5% of the time. Future cycles are expected to have more efficient startups and fewer trips so that this conclusion applies to future cycles as well.

Technical Specification Surveillance Requirement 4.1.1.3.a states that the MTC shall be measured and compared to the BOC limit specified in the COLR, prior to initial operation above 5% of rated thermal power, after each fuel loading. Figure 2 illustrates the hot zero power (HZP), ARO, MTC limit which should be placed in the COLR for a typical cycle to assure that the limiting HFP, ARO MTC is not less negative than -3 pcm/°F. From Figure 2, the upper MTC limit for a typical cycle would be 2.3 pcm/°F.

In the future, cycles will be designed so that the maximum upper MTC limit of Technical Specification 3.1.1.3 and the hot zero power (HZP), all rods out (ARO) MTC limit in COLR is met. The cycle specific HZP, ARO MTC limit in COLR will be adjusted, if necessary, to assure that the predicted MTC at BOC, ARO, hot full power (HFP) is equal to or more negative than the value used (-8 pcm/°F) in the generic ATWS analysis. This assures that operation with a PMTC will proceed in compliance with the risk goal of the ATWS Rule by limiting the MTC to the value assumed in supporting generic analysis[8,9].

The combination of proposed changes to Technical Specifications, Bases, and the COLR will allow core operation with a PMTC while assuring plant safety through:

1) compliance with the upper MTC limit assumed in the YAEC-1871 safety analysis approved in License Amendment No. 33; and

2) compliance with the risk goal of the ATWS Rule by limiting the MTC to the value assumed in supporting generic analysis.

References

1. NYN-93160, Letter from T.C. Feigenbaum (NAESCO) to USNRC, "License Amendment Request 93-18: Wide Band Operation and Core Design Enhancements (TAC No. M87849)", November 23, 1993.

2. YAEC-1871, A.E. Ladieu, et.al., "Safety Analysis in Support of Wide-Band Operation and Core Design Enhancements for Seabrook Station", September, 1993.

3. WCAP-11993, B.D. Sloane et. al., "Joint Westinghouse Owners Group/Westinghouse Program: Assessment of Compliance With ATWS Rule Basis for Westinghouse PWRs", December, 1988.

4. ATWS Final Rule - Code of Federal Regulations 10CFR50.62 and Supplementary Information Package, "Reduction of Risk from Anticipated Transients Without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants".

5. Letter from A.W. De Agazio (USNRC) to T.C. Feigenbaum (NAESCO), "Amendment No. 33 to Facility Operating License NPF-86: Wide-Band Operation and Core Enhancements - License Amendment Request 93-18 (TAC M87849)", November 23, 1994.

6. Letter from A.W. De Agazio (USNRC) to T.C. Feigenbaum (NAESCO), "Correction to Amendment 33 to Facility Operating License NPF-86 (TAC M87849)", December 6, 1994.

7. SECY-83-293, USNRC, W.J. Dirks, "Amendments to 10CFR50 Related to Anticipated Transients Without Scram (ATWS) Events", July 19, 1983.

8. NS-TMA-2096, Letter from T. M. Anderson (W) to R. J. Mattson (USNRC), "ATWS Submittal", June 8, 1979.

9. NS-TMA-2182, Letter from T. M. Anderson (W) to S. H. Hanauer (USNRC), "ATWS Submittal", December 30, 1979.

FIGURE 1

SEABROOK STATION CYCLE 4 MODERATOR TEMPERATURE COEFFICIENT
(ARO; Equilibrium Xenon)

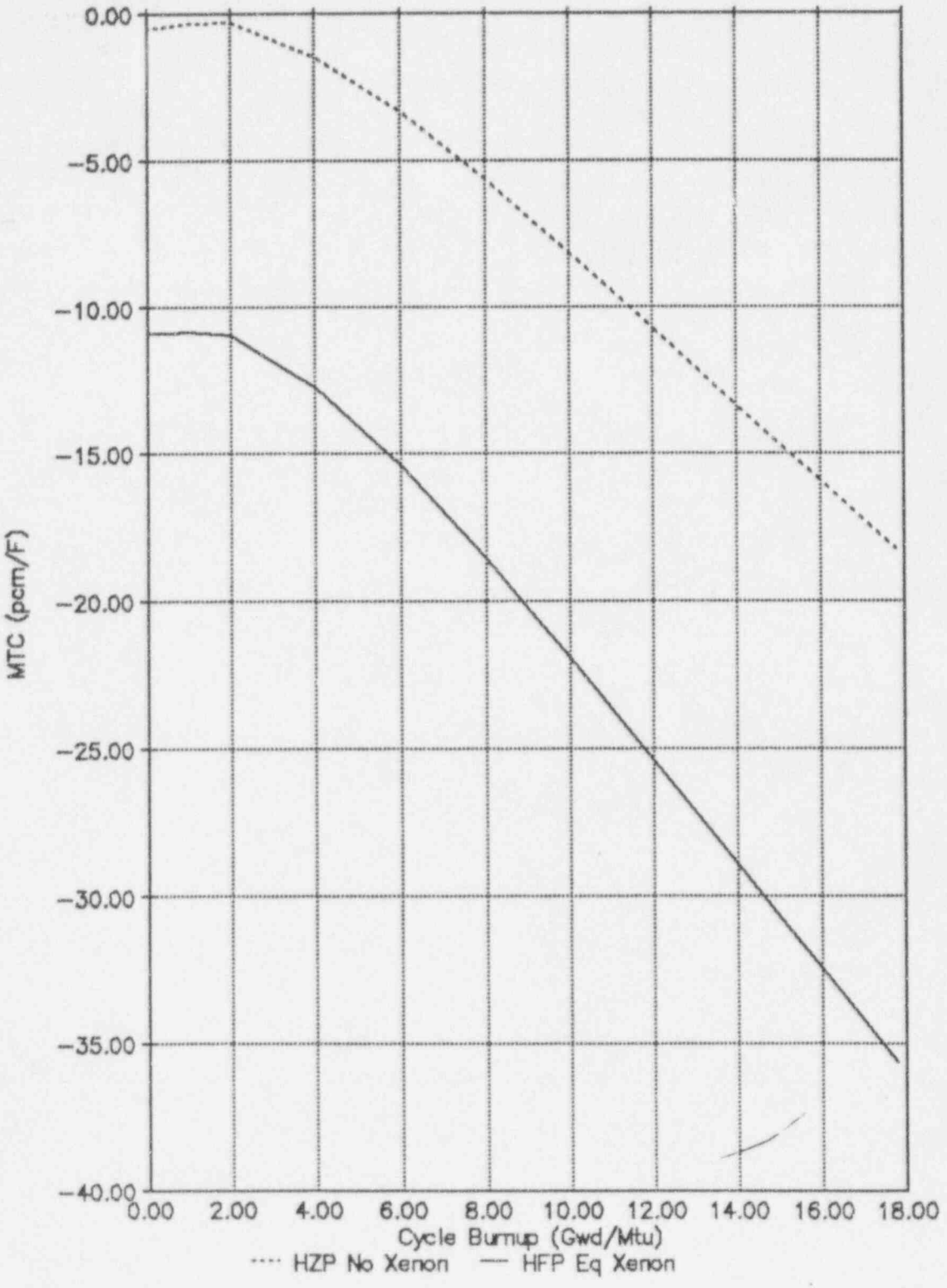
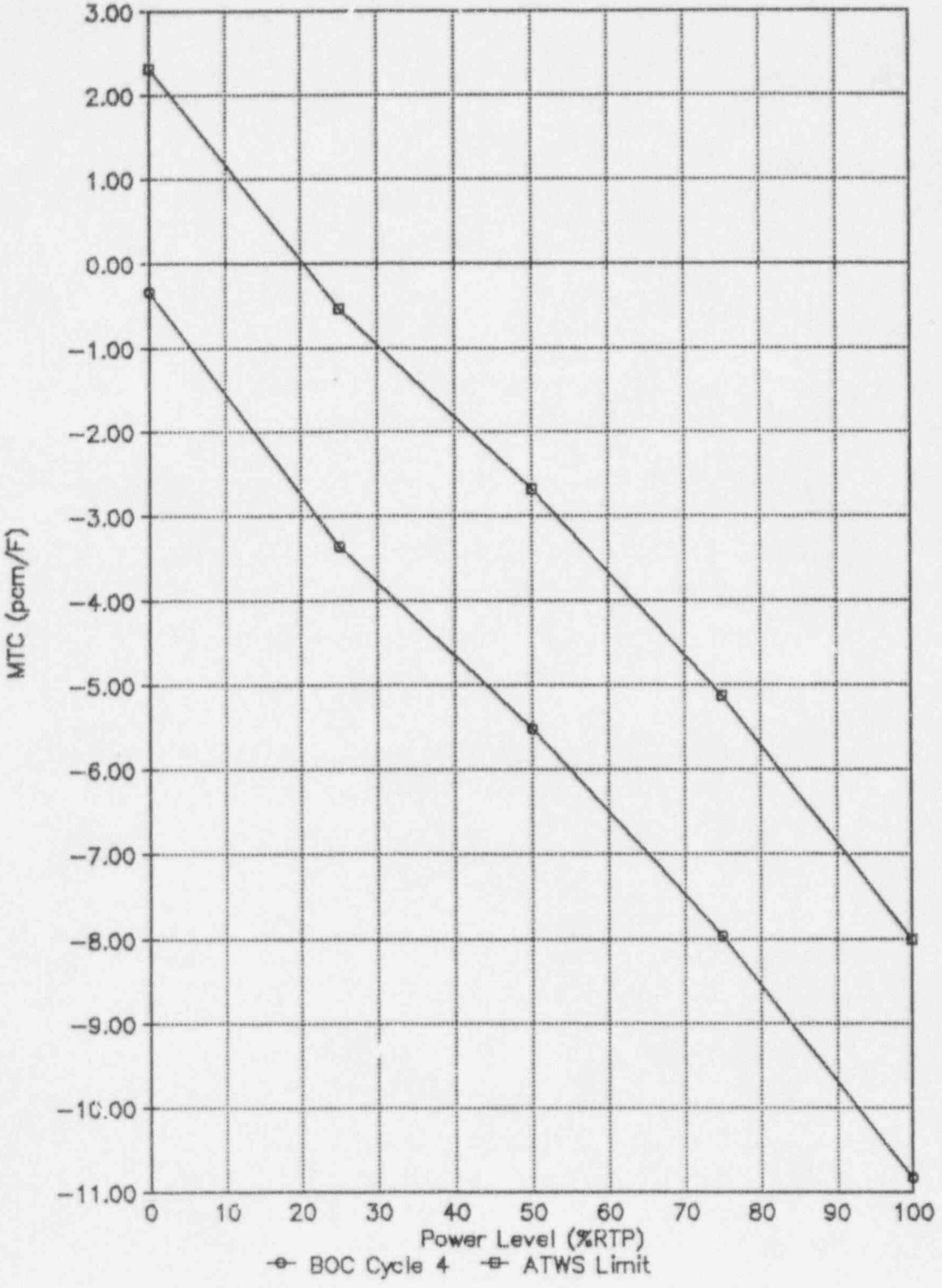


FIGURE 2

SEABROOK STATION CYCLE 4 MODERATOR TEMPERATURE COEFFICIENT
(BOC; ARO; Equilibrium Xenon)



II. MARKUP OF LAR 95-05 PROPOSED CHANGES

The enclosed markup pages reflect the currently issued version of Technical Specifications and Bases and include the changes approved in License Amendment No. 33, Wide-Band Operation and Core Enhancements[5,6]. Revision bars are provided in the right margin to designate a change in the text.