UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NOS. 35 AND 26 TO

FACILITY OPERATING LICENSE NOS. NPF-76 AND NPF-80

HOUSTON LIGHTING & POWER COMPANY

CITY PUBLIC SERVICE BOARD OF SAN ANTONIO

CENTRAL POWER AND LIGHT COMPANY

CITY OF AUSTIN, TEXAS

DOCKET NOS. 50-498 AND 50-499

SOUTH TEXAS PROJECT, UNITS 1 AND 2

1.0 INTRODUCTION

By application dated August 30, 1991 (ST-HL-AE-3830), Houston Lighting & Power Company, et.al., (the licensee) requested changes to the Technical Specifications (Appendix A to Facility Operating License Nos. NPF-76 and NPF-80) for the South Texas Project, Units 1 and 2 (STP). The proposed changes would incorporate an additional reference in the Technical Specification (TS) for the methodology used for calculations included in the Core Operating Report. Specifically, the use of the methodology would result in the calculation of a more negative end of life (EOL) moderator temperature coefficient (MTC) and the associated 300 ppm surveillance requirement (SR) limits specified in the Core Operating Limits Report (COLR). The purpose of the 300 ppm SR is to ensure that the most negative MTC at EOL remains within the bounds of the STP safety analysis, in particular for those transients and accidents that assume a constant value for the moderator density coefficient (MDC) of 0.43 Delta k per gm/cc. The methodology is included in Westinghouse Report WCAP-12942, "Safety Evaluation Supporting a More Negative EOL Moderator Temperature Coefficient Technical Specification for the South Texas Project, Units 1 and 2." In its letter of January 24, 1992, the licensee requested a 10-day implementation period following the date of issuance of the license amendment.

2.0 BACKGROUND

The current STP TS 3.1.1.3 states that:

> "The moderator temperature coefficient (MTC) shall be within the beginning of cycle (BOC) and EOC limit specified in the COLR."

The corresponding action for exceeding this limiting condition for operation (LCO) is to be in hot shutdown within 12 hours. The STP SR involves an MTC measurement at any thermal power within 7 effective full power days (EFPD) after reaching an equilibrium primary coolant boron concentration of 300-ppm.

After appropriate corrections are made, the measured value is compared to the 300-ppm SR limit value specified in the COLR at the all rods out (ARO) rated thermal power (RTP) condition. In the event that the measured MTC is more negative than the 300-ppm SR limit, the MTC must be remeasured and compared with the EOC MTC LCO value at least once per 14 EFPD during the remainder of the operating cycle. The STP Units 1 and 2 300-ppm SR and end-of-cycle (EOC) LCO values for the most negative MTC are conservative (less negative) when compared to the value of the MTC which is used in the safety analyses.

STP proposed to revise the current method for determining the 300-ppm surveillance and the EOC MTC limits specified in the COLR. The revised method for determining the COLR MTC limits will result in the addition of a reference to WCAP-12942 in the TS and in a change to the Technical Specification Bases Section B 3/4.1.1.3. This revised method and the COLR MTC limit changes do not affect the maximum moderator density coefficient (MDC) value of -56 pcm/°F. These changes apply to the current and future reload cycles for STP Units 1 and 2, and are supported by an evaluation provided by Westinghouse methodology (WCAP-12942). The analysis applies only to STP and is similar to that approved for use at other nuclear power plants.

3.0 EVALUATION

3.1 Amendment to End of Cycle Moderator Temperature Coefficient.

The current method used to determine the most negative MTC is described in Bases Section 3/4.1.1.3 of the TS for STP Units 1 and 2. This method is based on incrementally correcting the conservative MDC used in the safety analyses to obtain the most negative MTC value or, equivalently, the most positive MDC at the nominal hot full power (HFP) core conditions. The corrections involve subtracting the incremental change in the MDC, which is associated with the core condition of all control rods inserted (ARI), to an ARO core condition. The MTC is then equal to the product of multiplying the MDC by the rate of change of the moderator density with the temperature at RTP conditions.

The TS Bases provide a method of determining the most negative MTC LCO value which results in an ARO MTC value that is significantly less negative than the MTC used in the safety analysis and which may even be less negative than the best estimate EOC ARO MTC for extended burnup reload cores. This could result in the plant being required by TS 3.1.1.3 to be placed in a hot shutdown condition even though it would retain a substantial margin to the safety analysis MDC. The problem with the current method is caused by adjusting the MDC from an HFP ARI condition to an HFP ARO condition in defining the most negative MTC. The TS on control rod positions does not allow the HFP ARI condition for allowable power operation in which the shutdown banks are completely withdrawn from the core and the control banks must meet the rod insertion limits (RILs).

Westinghouse has provided the most negative feasible (MNF) MTC as an alternative method for adjusting the safety analysis MDC to obtain a most negative MTC. The MTC method seeks to determine the conditions for which a core will exhibit the most negative value that is consistent with operation allowed by the TS. For example, the MNF MTC method would not require the conversion assumption of the ARI HFP condition, but would require the conversion assumption that all control rod banks are inserted to the maximum amount that is permitted by the TS. Westinghouse uses the MNF MTC method to determine EOC MTC sensitivities to those design and operational parameters that directly affect the MTC in such a way that the sensitivity to one parameter depends on the assumed values for the other parameters.

The parameters considered with this MNF MTC method include:

(1) soluble boron concentration in the primary coolant
(2) moderator temperature and pressure,
(3) control rod insertion,
(4) axial power shape, and
(5) transient xenon concentration

The MNF MTC approach uses this sensitivity information to derive an EOC ARO HFP MTC LCO value based on the safety analysis value of the MDC.

Westinghouse stated that this MNF MTC approach has a number of advantages over the previous method for determining the most negative MTC LCO value. The MNF MTC will be sufficiently negative so that repeated MTC measurements from a concentration of 300-ppm of boron in the core to EOC would not be required. The MNF MTC method does not change the moderator feedback assumption or the value of the MDC in the safety analysis. The MNF MTC method is a reasonable basis to assume for an MTC value of a reload core and is consistent with plant operation defined by other TS. Finally, the MNF MTC method retains the SR on MTC at the 300-ppm core condition to verify that the core is operating within the bounds of the safety analysis.

Westinghouse has determined the sensitivity of the above parameters on the EOC MTC based on six reload designs representative of the future STP Units 1 and 2 reloads. These reload designs include fuel designs, discharge burnups, and cycle lengths which are typical of those expected for STP. The concentration of soluble boron was not used in the sensitivity analysis because the TS value for the MTC at the EOC HFP ARO conditions is assumed to be at 0-ppm of boron, the definition of EOC, and because the most negative MTC occurs at 0-ppm of boron in the coolant.

The sensitivity study did not include the radial power distribution which can vary under normal operation and can affect the MTC. The operational activities that affect the radial power distribution do so through the movement of control rods and other activities that affect the xenon concentration. The allowed changes in the radial power distribution are implicitly included in the MTC sensitivity to control rod insertion and xenon concentration.

Westinghouse stated that the SR MTC value would be obtained in the same manner as currently described in the Westinghouse Standard Technical Specification (STS) Bases. The SR MTC value is obtained from the EOC ARO MTC value by making corrections for burnup and boron at a core condition of 300-ppm of boron.

The staff has reviewed the assumptions and basis for the MNF MTC method described and concludes that they are acceptable because they will result in the most negative MTC SR and EOC values that could result from allowed operation of STP Units 1 and 2 from nominal conditions and because the MTC measurement at 300-ppm of boron core condition will ensure, using the SR value of MTC, that the safety analysis MDC will not be exceeded.

3.1 MDC Assumption Used in the South Texas Project Units 1 and 2 Accident Analysis

Westinghouse uses an MDC for performing accident analyses. To perform an analysis for events sensitive to maximum negative moderator feedback, Westinghouse uses a constant value of the MDC of 0.43 delta-K/gm/cc as an assumption throughout the analysis. The average temperature and pressure for HFP and full flow nominal operating conditions are 593.5°F and 2235 psig, respectively. At these conditions, the MTC, equivalent to the MDC of 0.43 delta-K/gm/cc, is -57.6 pcm/°F. The staff reviewed these assumptions and concludes that the evaluation of the MTC from MDC is acceptable because it conforms to the physical relationship of MTC to MDC; that is, the MTC is equal to the MDC times the rate of density with temperature at the nominal pressure and temperature of the coolant at rated thermal power conditions.

3.2 Sensitivity Results

STP Units 1 and 2 TS 3.2.5 provides the LCO of the departure from nucleate boiling (DNB) parameters; reactor coolant systems average temperature (T avg) and pressurizer pressure. The minimum allowable indicated pressurizer pressure is 2201 psig and the maximum allowable (T avg) is 598.0 °F. To account for expected future fuel designs and possible power update conditions, bounding values for RCS pressure of 2201 psig and for RCS temperature of 598.0°F were used for the Westinghouse analyses. The current nominal design (T avg) for STP Units 1 and 2 is 593.0°F so that the safety analysis represents a 5.0°F maximum allowable increase over (T avg) nominal conditions. The current nominal design pressure is 2235 psig, so that the safety analysis represents a 34.0 psi maximum allowable decrease from nominal pressurizer pressure. Based on these maximum allowed system variations, a maximum allowable limit is placed on the moderator density variation. Using the sensitivity of the MTC to temperature and pressure, derived from the analysis of six reload designs, Westinghouse obtained for STP Units 1 and 2 a bounding delta MTC (a proprietary value) associated with these maximum allowable coolant temperature and pressure deviations from nominal conditions.

TS 3.1.3.6 limits control bank insertion by RILs in Modes 1 and 2. All control rods can be inserted at hot zero power (HZP) simultaneously with a reactor trip. In general, control rod insertion results in a more negative

MTC if all other parameters are held constant. However, greater control rod insertion will also reduce the core power and (T avg) which causes the MTC to become more positive. This effect is more pronounced at lower power with the positive change being more important than the negative change in the MTC.

Westinghouse determined that the MTC will be more negative at HFP with control rods inserted to the RIL. Westinghouse analyzed a typical reload core design, using a bounding value of control bank insertion at HFP with no soluble boron in the coolant. This analysis gave a bounding delta MTC associated with the control bank inserted to the RIL for STP Units 1 and 2.

All of the delta MTC values described above are summed to provide a total delta MTC for STP Units 1 and 2 based on the allowed deviations of the various factors from nominal values.

The staff has reviewed the discussion and analysis of the primary factors of the MNF MTC method and concludes that the results obtained are acceptable because approved methods and assumptions were used to generate the results.

3.3 Effect of the MNF MTC on the Safety Analysis

Changes in the parameters discussed previously could take place during a transient to make the MTC more negative than allowed during normal operation. The most adverse conditions seen in the affected transient events will not result in a reactivity insertion that would invalidate the conclusions of the FSAR accident analyses. Thus, the MDC used as a basis for the MNF MTC TS will not change. The reload safety analysis process will include verification that the MDC safety analysis value remains valid. The staff concludes that this verification process for the safety analysis MDC is acceptable.

4.0 SUMMARY

The staff concludes that the proposed change to the method of determining the EOC MTC and 300-ppm SR limit values specified in the COLR is acceptable based on the following considerations:

(1) The most negative feasible MTC method considered the important factors affecting the MTC and the limits on these factors.

(2) Westinghouse used approved methods and computer codes in the analysis.

(3) Measuring the MTC at or near 300-ppm of boron will provide assurance that the MTC at EOC HFP ARO conditions will be less negative than the safety analysis.

(4) The licensee will analyze future reloads for STP Units 1 and 2 to confirm the most negative MTC TS at EOC and SR on MTC at a core condition of 300-ppm of boron.

(5) The licensee will analyze future reloads for STP Units 1 and 2 to confirm that the safety analysis value of the MDC applies.

5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Texas 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 (56 FR 51926). 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.

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Date: April 2, 1992