BALTIMORE
GAS AND
ELECTRIC

CHARLES CENTER • P.O. BOX 1475 • BALTIMORE, MARYLAND 21203-1475

GEORGE C. CREEL
VICE PRESIDENT
NUCLEAR ENERGY
(301) 260-4455

August 13, 1990

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
License Amendment Request - Low Temperature Overpressure Protection (LTOP)

REFERENCES:

(a) Letter from Mr. D. G. McDonald, Jr. (NRC) to Mr. G. C. Creel (BG&E), dated July 24, 1990, Issuance of Amendment No. 145 (TAC No. 76130)

(b) Letter from Mr. G. C. Creel (BG&E) to NRC Document Control Desk, dated July 18, 1990, Request for Emergency License Amendment

(c) Letter from Mr. G. C. Creel (BG&E) to NRC Document Control Desk dated May 14, 1990, Request for Technical Specification Change

(d) Letter from Mr. G. C. Creel (BG&E) to NRC Document Control Desk dated October 27, 1989, Request for Amendment

Gentlemen:

By letter dated July 24, 1990 (Reference a), the Nuclear Regulatory Commission issued Amendment No. 145 to Facility Operating License DPR-53 for Calvert Cliffs Unit 1. The amendment consisted of changes to the Technical Specifications proposed by Baltimore Gas and Electric (BG&E) Company's application dated May 14, 1990 (Reference c), as modified by letter dated July 18, 1990 (Reference b).

Amendment No. 145 replaced the existing 0-10 effective full power year (EFPY) and 10-40 EFPY heatup and cooldown curves with 0-12 EFPY heatup and cooldown curves based on Regulatory Guide 1.99, Revision 2. In addition, new controls were implemented to establish adequate low temperature overpressure protection (LTOP). These included: (1) adjustments to the LTOP mitigating system; i.e., the power operated relief valve (PORV) pressure lift setting and enable temperature; (2) changes to reactor coolant pump (RCP) controls; (3) changes to clarify high pressure safety injection (HPSI) operability requirements; and (4) modifications to HPSI pump controls.

A001
1/1

The RCP controls, unlike the other controls proposed in Reference (b), were temporary and only valid for the current low decay heat condition (60 days shutdown). These controls were put in place on an emergency basis to allow a continuation of the Unit 1 outage while analyses were completed for long-term RCP controls. Continuation of the outage was achieved when early on July 27, 1990, reactor coolant system (RCS) integrity was established and a reactor coolant loop was made operable in accordance with Technical Specification 3.4.1.3. This allowed one train of the Saltwater System to be taken out-of-service for maintenance. This maintenance is currently proceeding.

The analysis of long-term requirements for the control of RCP starts has been completed. The results indicate that only modest adjustments to the current controls are required to still be effective in the mitigation of energy addition events when low temperature overpressure protection is required. Accordingly, the purpose of this letter is to describe the methods and results of the final analyses and to propose changes to:

- the heatup and cooldown curves and rates;
- the PORV lift setting; and
- the RCP start controls.

These changes must be implemented prior to entry into **MODE 2,** which is currently scheduled for September 18, 1990. Therefore, we request that you approve these changes before that date.

Another purpose of this letter is to notify you that our response to Nuclear Regulatory Commission (NRC) Generic Letter 88-11, submitted to you by letter dated October 27, 1989 (Reference d), will require modification in view of our overall re-evaluation of LTOP. Our response included a request for new 16 EFPY heatup and cooldown curves based on new methods developed by ABB Combustion Engineering Nuclear Power (C-E). Whereas the methodology proposed by C-E will not be affected, changes will be necessary in the proposed plant-specific administrative controls related to LTOP.

Attachment (1) provides the proposed markup of the technical specifications affected by this amendment request. Attachment (2) is a revised LTOP system description.

I. SUMMARY

A. APPROACH

The RCP start controls implemented by Reference (a) only apply to current Unit 1 conditions with a low decay heat load. New analyses have been performed for the higher decay heat loads that exist shortly after (i.e. 8 hours or more) a reactor shutdown. The results demonstrate that new RCP start controls, in conjunction with revised pressure-temperature limits and an increased PORV setpoint, will prevent challenges to the PORV for planned RCP starts under these conditions. A single PORV will adequately mitigate energy addition transients that may occur if the RCPs are started in response to a loss of decay heat removal when decay heat loads are high and letdown is isolated.

B. HEATUP AND COOLDOWN CURVES AND RATES

The proposed change to the Technical Specifications will revise the existing 0-12 EFPY heatup and cooldown curves and rates. The existing 0-12 EFPY heatup and cooldown curves and rates are based on the calculation of a family of P-T limit curves that comprise the basis of References (b) and (c), as approved by NRC in Reference (a). Each of the P-T limit curves within this "family of curves" is associated with a unique heatup and cooldown rate. We have gone back to that data and have selected new 0-12 EFPY curves that correspond to lower heatup and cooldown rates. With a lower allowable rate of temperature change, the corresponding maximum allowable pressures are increased as reflected in a shift upward in the P-T limit (heatup and cooldown) curves. The effect of the selection of these lower rates, then, is greater operational flexibility with higher allowable Appendix G pressures.

The above changes permit the low temperature PORV pressure lift setpoint to be increased to accommodate higher decay heat values in the RCP start transient analyses (corresponding to approximately 8 hours following reactor shutdown). The low temperature PORV pressure lift setpoint is based on protecting the most limiting pressure of the applicable heatup and cooldown Appendix G curves. This occurs during a cooldown at a temperature of 70°F. Through the selection process discussed above, the minimum allowable Appendix G pressure has increased by 39.6 psi. Consequently, the pressure limit which the PORV must protect when the RCS is below the MPT enable temperature has been increased by the same amount. Specifically, the maximum allowable pressurizer pressure (not including pressure instrument uncertainty) when in MPT enable has increased from 424.5 psia to 464.1 psia.

The maximum allowable heatup rate of 60°F/hr, for an RCS temperature of 70°F to 305°F, has been reduced to 40°F/hr and will be applicable for temperatures of 70°F to 313°F. The maximum allowable heatup rate of 10°F/hr will now be applicable for 314°F to 327°F rather than the previous temperature range of 305°F to 327°F. The maximum allowable cooldown rate for less than 170°F has been changed from 20°F to 10°F/hr.

Revised Technical Specification Figures 3-4.2a and 3-4.2b (heatup and cooldown curves) have been conservatively developed in accordance with the requirements of 10 CFR 50 Appendix G, as supplemented by Appendix G to Section III of the ASME Boiler and Pressure Vessel Code, 1986 Edition. The adjusted RT_{NDT} values used in their development have been conservatively calculated using the methodology provided in Regulatory Guide 1.99 Revision 2, and are based upon the peak neutron fluence experienced by the reactor beltline region through a period of 12 Effective Full Power Years.

C. LTOP CONTROLS

The low temperature PORV pressure lift setpoint is based on protecting the most restrictive pressure of both the heatup and cooldown curves. The most restrictive pressure limitation is for the 10°F/hr cooldown at 70°F in the RCS. With the P-T limits being revised as previously described, the maximum allowable pressurizer pressure (not including pressure instrument uncertainty) when in MPT enable has increased from 424.5 to 464.1 psia. A setpoint of 430 psia, which includes

instrumentation uncertainties and sufficient margin for PORV response time requirements necessary for the protection of 464.1 psia, was selected. [NOTE: It should be pointed out that the existing PORV lift setting in Technical Specification 3.4.9.3 is $\leq$ 424.5 psia. This value represents the P-T limit, without instrument uncertainties. The actual PORV setpoint in the plant, with uncertainties accounted for, is 384.4 psia. Henceforth, the actual PORV setting will be shown in the technical specifications for clarity (430 psia).]

The LTOP enable temperature was developed using the guidance found in NRC Standard Review Plan 5.2.2, Revision 2. The enable temperature was originally developed with the 12 EFPY P-T limits proposed in Reference (c) [and approved in Reference (a)]. The enable temperature was calculated using specific heatup transients with changing thermal rates to reduce the applied thermal stress. The selection of the more restrictive heatup and cooldown rates and the resulting allowable pressure limits as described above do not impact the LTOP enable temperature. Therefore, the LTOP enable temperature remains unchanged.

D. RCP START CRITERIA

Modifications made to the plant heatup and cooldown curves and associated rates permit raising the PORV setpoint. The higher PORV setpoint provides additional margin to accommodate possible pressurization transients after starting two (2) reactor coolant pumps. The thermal-hydraulic analysis of RCP start transients has been upgraded to more accurately, but conservatively, simulate thermodynamic conditions within the pressurizer. Calculations have also statistically combined instrumentation uncertainties, providing additional margin in assumed initial conditions for transient analysis. These improvements provide a set of operating conditions which permit normal RCP starts without challenging the PORV.

The plant conditions which must be satisfied for RCP starts are as follows:

- indicated initial pressurizer pressure less than or equal to 290 psia. This is a decrease of 10 psi from the current limit of 300 psia.

- indicated initial pressurizer level less than or equal to 170 inches. This is an increase of 5 inches from the current limit of 165 inches.

- indicated steam generator secondary temperature no more than 30°F higher than indicated RCS temperature. This is no change from the current limit.

E. RCP START TRANSIENT ANALYSIS

Initial conditions for pressurizer pressure, pressurizer level, and steam generator-to-RCS delta-T are determined by statistical combination of instrumentation uncertainties. The statistical analysis provides at least a 95% confidence that 95% of the instrumentation uncertainty combinations are bounded. The methodology used a root-sum-square combination of instrument uncertainties, combined with sensitivity coefficients based on partial derivatives of peak pressure with respect to initial pressurizer pressure and level, and steam generator - to - RCS delta-T.

Pressurizer insurge was calculated for limiting decay heat loads and steam generator-to-RCS delta-T. Analysis includes energy addition from two RCPs. Letdown is assumed to be isolated, and no credit is taken for sensible heat absorption by the RCS component metal mass except as described below. Limiting insurge results are input to the pressurizer model described below.

Prior to the calculations described in our July 18, 1990 submittal [Reference (b)], LTOP calculations of the RCS pressure rise for the LTOP energy addition transients (starting of RCPs) consisted of a calculation of the pressure change resulting from an adiabatic compression of the pressurizer steam space. Because an adiabatic process was assumed, no credit was taken for heat transfer mechanisms that would act to reduce the pressure rise following an insurge (i.e., condensation of steam on the pressurizer walls as a result of wall heat transfer).

For this analysis, a simple computer model of the pressurizer was developed to more accurately calculate the transient pressure response as a function of time. The model consists of three regions where Region 1 is the steam space, Region 2 is the initial saturated liquid volume, and Region 3 is the subcooled liquid region at the bottom of the pressurizer which is formed as a result of the transient insurge. The state conditions that can exist for each region are: saturated or superheated steam in Region 1, saturated or subcooled water in Region 2, and subcooled water in Region 3.

Mass and energy transfer between Regions 1 and 2 is assumed to occur only as the result of liquid vaporization and/or steam condensation. Mass and energy transport into or out of the pressurizer is assumed to occur only as the result of surge flow, pressurizer heater input, and wall heat transfer for this analysis. No credit is taken for condensation of steam on the liquid-steam interface, or for the mixing of, or transfer of heat between the initially saturated liquid and the colder insurge liquid. Heat transfer is assumed to occur radially through the wall. No credit is taken for heat conduction to other structures.

F. MASS ADDITION TRANSIENTS

The changes in PORV setpoints and pressure-temperature limits do not affect the existing mass addition transient controls.

G. QUALITY VERIFICATION

As in the development of Reference (b), ABB Combustion Engineering Nuclear Power (CE) was consulted extensively during this analysis effort. Calculations performed by BG&E and CE were closely coordinated to ensure the analytical approach and methods used were appropriate. The consultation and analysis by CE provide added assurance that the analyses presented here are accurate.

II. REQUEST FOR LICENSE AMENDMENT

The Baltimore Gas and Electric Company hereby requests an amendment to Operating License DPR-53 for Calvert Cliffs Unit 1 with the submittal of the proposed Technical Specifications in Attachment (1). These changes are required prior to entry into **MODE** 2,

STARTUP. Unit 1 is currently scheduled to enter **MODE** 2 on September 18, 1990; therefore we request approval of these changes before that date.

A. DESCRIPTION OF CHANGES

1. Heatup and Cooldown Curves and Rates

a. Change Technical Specification Limiting Condition for Operation (LCO) 3.4.9.1.a (p. 3/4 4-23), maximum allowable heatup rates, as follows:

Maximum Allowable Heatup Rate	RCS Temperature
(FROM)	
60°F in any hour period	70°F to 305°F
10°F in any hour period	305°F to 327°F
60°F in any hour period	≥ 327°F
(TO)	
40°F in any hour period	70°F to 313°F
10°F in any hour period	314°F to 327°F
60°F in any hour period	> 327°F

b. Change Technical Specification LCO 3.4.9.1.b (p. 3/4 4-23) to limit the cooldown rate to 10°F per hour when RCS temperature is below 170°F. The current limit is 20°F per hour cooldown rate.

c. Replace old Technical Specification Figures 3.4-2a and 3.4-2b (pp. 3/4 4-24 and 4-24a), RCS Pressure-Temperature Limits, with new Technical Specification Figures 3.4-2a and 3.4-2b.

2. LTOP Controls

a. Change the PORV lift setting of Technical Specification LCO 3.4.9.3.a.1 and 2 (p. 3/4 4-26a) from "≤ 424.5 psia" to "≤ 430 psia."

b. For references to the MPT enable temperature, where the wording "below 327°F" occurs, change it to "327°F or less." This is an editorial change for consistency with other references to MPT enable

temperature; i.e., "≤ 327°F," and more properly reflects its meaning." Affected Technical Specifications are:

TS	PAGE
3.1.2.1	3/4 1-8
3.1.2.3	3/4 1-10
Table 3.3-3	3/4 3-11
4.5.2	3/4 5-4
3.5.3	3/4 5-6
Bases 3/4.4.9	B 3/4 4-8
Bases 3/4.5.2	B 3/4 5-2

3. RCP Start Criteria

a. Change the RCP start controls in footnote (***) to the APPLICABILITY of Technical Specification 3.4.1.3 (p. 3/4-2a) as follows:

	FROM	TO
Pressurizer water level	≤ 165 inches	≤ 170 inches
Pressurizer pressure	≤ 300 psia	≤ 290 psia

b. Add a footnote (**) to the APPLICABILITY of Technical Specification 3.4.1.2 (p. 3/4 4-2) to provide RCP start controls consistent with those existing in Technical Specification 3.4.1.3.

c. Also in footnote (***) to Technical Specification 3.4.1.3 delete the requirement to measure pressurizer pressure " ... by plant computer or equivalent precision instrument," and the restriction on entry into **MODE** 2. These requirements were part of the temporary RCP controls established by Reference (a) and are no longer needed. Normal control room panel indication of pressurizer pressure is sufficient for implementation of the newly proposed controls. The new controls are also valid for higher decay heat loads, therefore the restriction from entry in **MODE** 2 can be removed.

4. TS Bases

Revise Technical Specification Bases 3/4.4.1, Coolant Loops and Coolant Circulation and Bases 3/4.4.9, Pressure/Temperature Limits, to be consistent with the above changes.

B. DETERMINATION OF NO SIGNIFICANT HAZARDS

These proposed changes have been evaluated against the standards in 10 CFR 50.92 and have been determined to involve no significant hazards considerations, in that operation of the facility in accordance with the proposed amendment would not:

(i) *involve a significant increase in the probability or consequences of an accident previously evaluated; or*

The existing Unit 1 12 EFPY P-T limits (approved by Reference a) were conservatively developed in accordance with the fracture toughness requirements of 10 CFR 50, Appendix G, as supplemented by the ASME Code Section III, Appendix G. The reactor vessel material Adjusted RT_{NDT} values are based on the conservative methodology provided in Regulatory Guide 1.99, Revision 2. This amendment will not change the P-T limit calculations that are the basis for the existing heatup and cooldown curves; however, a new combination of heatup and cooldown curves and associated rates has been selected from this set of limits. This new selection, which features lower heatup and cooldown rates, permits the Appendix G allowable pressure to be increased for corresponding temperatures, thereby increasing the region of allowable operations with reactor coolant pumps. This additional operational flexibility minimizes the potential for pressure transients that could challenge the P-T limits during normal plant startup and shutdown evolutions. The new heatup and cooldown curves and associated limits continue to provide conservative administrative restrictions on reactor coolant system pressure to minimize material stresses in the RCS due to normal operating transients, thus minimizing the likelihood of a rapidly propagating fracture due to pressure transients at low temperature. Because these new heatup and cooldown curves and rates are based on the same P-T limits approved in Reference (a), this proposed amendment does not involve an increase in the probability or consequences of accidents previously evaluated.

Consistent with the selection of new heatup and cooldown curves and rates, the LTOP controls are being changed by increasing the PORV lift setting to 430 psia. The MPT enable temperature of 327°F is not being changed. The new PORV setpoint is based on protecting the most restrictive pressure of both the heatup and cooldown curves; i.e., a 10°F per hour cooldown at 70°F RCS temperature. Since the basis for the selection of the PORV setpoint has not changed, the PORV would provide the same degree of protection in mitigating postulated LTOP transients with the new setting as that provided by the present LTOP system. Therefore, this change does not increase the probability or consequences of accidents previously evaluated.

The lower heatup and cooldown rates and the increased PORV lift setting provides additional margin to accommodate postulated pressurization from energy addition transients. New calculations have been performed that more precisely predict the response to such transients. From these calculations, a revised set of RCP start controls have been selected that will permit planned RCP starts during normal operational activities without challenging the PORV. For the postulated start of 2 RCPs during recovery from a loss of

decay heat removal, the PORVs may be required to respond in cases where decay heat load is high if operator actions are either not taken or are ineffective. A single PORV has been determined to be capable of adequately mitigating this transient. Because these RCP controls now credit the function of the PORV to mitigate certain energy addition transients, this is considered a slight increase in the consequences of these transients. However, because the results of the analysis remain well within the conservative acceptance limits of 10 CFR 50 Appendix G, this increase is not significant.

(ii) *create the possibility of a new or different type of accident from any accident previously evaluated*

The changes to the heatup and cooldown curves and rates, PORV lift setting, and the RCP controls do not represent a significant change in the configuration or operation of the plant. Specifically, no new hardware is being added to the plant as part of the proposed change, no existing equipment is being modified, nor are any significantly different types of operations being introduced. Therefore, the proposed amendment would not create the possibility of a new or different kind of accident from those previously evaluated.

(iii) *involve a significant reduction in the margin of safety*

This change will ensure that the margin of safety is maintained with respect to an energy addition event in that there are no postulated events that could challenge the Appendix G curves. The changes to the controls placed on the variables for a planned RCP start are minor in nature and provide an additional margin of safety. The changes to the heatup and cooldown curves/rates and the PORV lift setting ensure that the margin safety is maintained by protecting the Appendix G limits for all postulated transients.

The changes made in the manner of reference to the MPT enable temperature are editorial. The MPT enable temperature is 327°F; therefore, all references to the LTOP temperature region should be "at 327°F and less," or equivalent. Since this is consistent with other existing references to MPT enable temperature, this change does not constitute a significant hazards consideration.

C. SAFETY COMMITTEE REVIEW

This proposed change to the Technical Specifications and our determination of significant hazards have been reviewed by our Plant Operations and Safety Review Committee and Off-Site Safety Review Committee, and they have concluded that implementation of these changes will not result in an undue risk to the health and safety of the public.

Very truly yours,

GCC

STATE OF MARYLAND :
: **TO WIT** :
County of Calvert :

I hereby certify that on the 13 day of August, 1990, before me, the subscriber, a Notary Public of the State of Maryland in and for Calvert County, personally appeared George C. Creel, being duly sworn, and states that he is Vice President of the Baltimore Gas and Electric Company, a corporation of the State of Maryland; that he provides the foregoing response for the purposes therein set forth; that the statements made are true and correct to the best of his knowledge, information, and belief; and that he was authorized to provide the response on behalf of said Corporation.

WITNESS my Hand and Notarial Seal:

Lynn M. Taylor
Notary Public

My Commission Expires:

February 2, 1994
Date

GCC/BSM/bjd

Attachments: (1) Proposed Technical Specification Changes
(2) LTOP System Description

cc: D. A. Brune, Esquire
J. E. Silberg, Esquire
R. A. Capra, NRC
D. G. McDonald, Jr., NRC
T. T. Martin, NRC
L. E. Nelson, NRC
R. I. M[illegible]an, DNR