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GAS AND
ELECTRIC

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February 6, 1992

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit No. 1; Docket No. 50-317
License Amendment Request; Low Temperature Overpressure Protection (LTOP)

REFERENCES:
(a) Letter from Mr. G. C. Creel (BG&E) to NRC Document Control Desk, dated August 13, 1990, License Amendment Request

(b) Letter from Mr. D. G. McDonald, Jr. (NRC) to Mr. G. C. Creel (BG&E), dated September 18, 1990, Issuance of Amendment No. 146 (TAC No. M77292)

Gentlemen:

The Baltimore Gas and Electric Company hereby requests an Amendment to its Operating License No. DPR-53 for Calvert Cliffs Unit No. 1 with the submittal of the proposed changes to the Technical Specifications.

DESCRIPTION

The proposed amendment would revise the Technical Specifications for Unit 1 to provide new heatup and cooldown curves to allow operation beyond 12 effective full power years (EFPY). The Power Operated Relief Valve (PORV) setpoint has also been revised, and the Minimum Pressure and Temperature (MPT) Enable temperature has been increased to 355°F to provide low temperature overpressure protection (LTOP) for an allowable fluence corresponding to approximately 22 EFPY based on the current core loading pattern. The temperature at which the high pressure safety injection (HPSI) pumps are placed under manual control during a reactor cooldown has been increased to 375°F due to the higher MPT temperature. To accommodate the lower Appendix G pressure limits associated with the new curves, the maximum allowed HPSI pump flowrate has been reduced from 210 gpm to 200 gpm when used to add mass to the Reactor Coolant System (RCS) . The criterion for the reactor to be shutdown for eight hours or longer before a Reactor Coolant Pump (RCP) is started has been removed from the bases, as it is no longer required.

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The initial indicated RCS pressure for starting an RCP has been increased to 300 psia. The Adjusted Reference Temperature (ART) for the 1/4 T and 3/4 T positions in the bases changed to 253.7°F and 193.8°F, respectively.

The technical specifications requested herein, while not constituting a safety concern, do not represent the desired approach for operating Calvert Cliffs in the long term. The enclosed heatup and cooldown curves in conjunction with RCP operating requirements, will allow for only a 50 psia window of operation at low temperatures. Long-term use of this restrictive operating window increases the possibility of RCP damage due to low pressure or an inadvertent PORV lift.

Until November 1991, it had been our intention to submit a new set of curves based on the new LTOP methodology described in ABB/C-E Topical Report CEN-381-P, "Low Temperature Overpressurization Transient Pressure-Temperature Limit for Determination of Low Temperature Overpressure Protection Setpoint" (and Attachment 1P, "Low Temperature Overpressure Protection Pressure-Temperature Limit Methodology Response to USNRC Inquiry," thereto). In fact, engineering had been complete and a license amendment application was under development. Submittal to the NRC was scheduled for December 1991. Adoption of this new methodology would have greatly increased operational flexibility at low temperatures while affording an equivalent degree of safety relative to current methods. CEN-381-P has been under review at NRC for at least two years and it was our understanding that approval could be expected in the fall of 1991. However, when we became aware that approval was not forthcoming and that no firm schedule existed for completion of the reviews, we halted our effort and shifted back to a licensing submittal that was based on existing Appendix G methods.

We prefer not to operate Calvert Cliffs under the constraints imposed by the current methods unless there is no other technically viable alternative. We believe the new methodology proposed by CEN-381-P to be technically viable, and intend to make a follow-on licensing submittal at mid-year. We request that the NRC complete its review of CEN-381-P consistent with this schedule.

BACKGROUND

In our License Amendment Request letter dated August 13, 1990 (Reference a), proposed revisions to LTOP Technical Specifications and a new LTOP system description were submitted for your review. By letter dated September 18, 1990 (Reference b), the Nuclear Regulatory Commission issued Amendment No. 146, which approved our request. This system description provided information on our approach to LTOP, which is based primarily on reducing the potential for overpressurization of the RCS through a combination of additional controls, administrative procedures and operator action. In general, this protection includes the following:

- Procedural precautions and controls;
- Disabling of non-essential components whenever LTOP is required (below the MPT Enable temperature and the RCS not vented);
- Avoidance of a water solid RCS whenever practical; and,
- Use of a low relief setpoint in the PORV control logic.

Attachment (1) provides the proposed markup of the technical specifications. A description of the changes that have been made to the LTOP system follows.

REQUESTED CHANGE

Change Unit 1 Technical Specifications as shown on the marked-up pages attached to this transmittal and as described below.

1. **Heatup and Cooldown Curves and Rates**

   a. Change Technical Specification Limiting Condition for Operation (LCO) 3.4.9.1.a, maximum allowable heatup rates, as follows:

Maximum Allowable Heatup Rates	RCS Temperature
(FROM)	
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
(TO)	
30°F in any hour period	70°F to 164°F
40°F in any hour period	> 164°F to 328°F
10°F in any hour period	> 328°F to 355°F
60°F in any hour period	> 355°F

   b. Change Technical Specification LCO 3.4.9.1.b, maximum allowable cooldown rates, as follows:

Maximum Allowable Cooldown Rates	RCS Temperature
(FROM)	
100°F in any one hour period	> 250°F
20°F in any one hour period	250°F to 170°F
10°F in any one hour period	< 170°F
(TO)	
100°F in any one hour period	> 254°F
20°F in any one hour period	254°F to 184°F
10°F in any one hour period	< 184°F

c. Replace Technical Specification Figures 3.4-2a and 3.4-2b, RCS Pressure-Temperature (P-T) Limits, with new figures. The revised curves and rates are based on a fluence of 3.25×10^{19} n/cm^2 (E>1 mev), which corresponds to approximately 22 EFPY based on the current core loading pattern. The revisions to the curves also made it necessary to revise the Adjusted Reference Temperatures (ART) for 1/4 T position and 3/4 T position in the bases. The ART for 1/4 T position has been changed from 222°F to 253.7°F and the ART for 3/4 T position has been changed from 162.5°F to 193.8°F.

2. **LTOP Controls**

a. Change Technical Specification 3.4.9.3.a.1 and 2 from "lift setting ≤ 430 psia" to "trip setpoint of ≤ 429 psia." Bases 3/4.4.9 has been changed to explain the new terminology used to describe the PORV setpoint.

b. The MPT enable temperature has been changed from 327°F to 355°F. The Technical Specifications that are affected by this change are 3.1.2.1, 3.1.2.3, Table 3.3-3, 3.4.1.2, 3.4.1.3, 3.4.9.3, 4.5.2, 3.5.3, Bases 3/4.4.1, Bases 3/4.4.9, and Bases 3/4.5.2.

c. Due to the higher MPT enable temperature, the transition region at which the high pressure safety injection (HPSI) pumps are placed under manual control on cooldown and restored to automatic status on heatup has been changed from 327°F - 350°F to 355°F - 375°F. This affects Technical Specification 3.5.3 and Table 3.3-3.

d. The allowable HPSI pump flowrate has been changed from "less than or equal to 210 gpm" to "less than or equal to 200 gpm" when used to add mass to the RCS. This affects Technical Specification 3.4.9.3, B3/4.4.9 and B3/4.5.2.

3. **RCP Start Criteria**

a. Change the RCP start controls for pressurizer pressure in footnote (***) to the APPLICABILITY section of Technical Specification 3.4.1.3 and in footnote (**) to the APPLICABILITY section of Technical Specification 3.4.1.2 from ≤ 290 psia to ≤ 300 psia.

b. Remove the criteria for reactor shutdown of eight hours or longer prior to RCP start from the Bases.

4. **Technical Specification Bases**

Revise Technical Specification Bases 3/4.4.1, Coolant Loops and Coolant Circulation, and Bases 3/4.4.9, Pressure/Temperature Limits, and Bases 3/4.5.2, ECCS Subsystem, to be consistent with the above changes.

5. **Clarification**

Add Technical Specification LCO 3.4.9.3.e to say, "When not in use, the above OPERABLE high pressure safety injection pump shall have its handswitch in pull-to-lock." To Technical Specification 4.4.9.3.3 add the surveillance requirement, "The above OPERABLE pump shall be verified to have its handswitch in pull-to-lock at least once per 12 hours."

Change Bases B3/4.9 to remove the discussion of temperature instrument uncertainty for the minimum boltup temperature. The margin between the calculated minimum boltup temperature of -10°F and the conservative administrative limit of 70°F ensures that plant operation is consistent with the safety analysis for minimum boltup temperature. It has also been clarified that the administrative limit of 70°F for minimum boltup temperature is the minimum allowable reactor vessel temperature at which the reactor vessel head can be attached in order to comply with the 10 CFR Part 50, Appendix G limits.

Change Bases B3/4.4.9 to replace the discussion of a figure that was developed to show the calculated RCS pressure versus time with a more descriptive discussion. That discussion addresses the mass addition transient, which is the basis for the PORV setpoint.

SAFETY ANALYSES/JUSTIFICATION

1. **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 P-T limit curves that comprise the basis of Reference (a), as approved by NRC in Reference (b). The new P-T limit curves are based on a fluence of 3.25×10^{19} n/cm^2 at the inner surface of the reactor vessel, which corresponds to approximately 22 EFPY of operation based on the current core loading pattern. This fluence is higher than the existing fluence (for 12 EFPY) and results in a lower Appendix G limit and a higher MPT enable temperature. Since the vessel embrittlement is actually based on fluence, and not EFPY, we find it more appropriate to base the curves on fluence. We have elected to propose heatup and cooldown curves based on a higher fluence, which corresponds to approximately 22 EFPY. The proposed curves correspond to different heatup rates. The cooldown rates remain the same, but the RCS temperature range changed for each of the rates. The proposed heatup and cooldown curves and rates are based on new P-T limits that were conservatively developed using the same methods as the existing curves in accordance with the fracture toughness requirements of 10 CFR 50, Appendix G, as supplemented by the ASME Code Section III, Appendix G.

Due to increased reactor vessel embrittlement caused by the higher fluence, the above changes require the low temperature PORV pressure trip setpoint to be lowered. The low temperature PORV pressure trip setpoint is based on preventing RCS pressure from exceeding the most limiting pressure of the applicable heatup and cooldown Appendix G curves. This occurs during a cooldown at a temperature of 70°F. Specifically, the maximum analytical pressurizer pressure (not including pressure instrument loop uncertainty and overshoot) when in MPT enable has decreased from 464.1 psia to 444.5 psia. The MPT enable temperature has been increased from 327°F to 355°F (includes temperature instrument loop uncertainty).

The maximum allowable heatup rate for RCS temperature has been changed to be applicable for temperatures as follows:

30°F/hr	70°F to 164°F
40°F/hr	> 164°F to 328°F
10°F/hr	> 328°F to 355°F
60°F/hr	> 355°F

The maximum allowable cooldown rates have been changed to be applicable for temperatures as follows:

100°F/hr	> 254°F
20°F/hr	254°F to 184°F
10°F/hr	< 184°F

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 approximately 22 EFPY based on the current core loading pattern.

2. **LTOP Controls**

The low temperature PORV pressure setpoint is based on protecting against exceeding 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 proposed P-T limits the maximum analytical pressurizer pressure (not including pressure instrument uncertainty and response time) when in MPT enable has been decreased from 464.1 psia to 444.5 psia. The existing PORV lift setting in the Technical Specification 3.4.9.3 is $\leq$ 430 psia. This value represents the "as left" trip setpoint, which includes all instrument loop uncertainties and response time.

In order to better define the PORV setpoint, the term "lift setting" has been replaced with "trip setpoint". The new technical specification trip setpoint value is less than or equal to 429 psia. The actual trip setpoint is controlled by plant procedures and is calculated considering response time and total loop uncertainties. Total loop uncertainties include allowances for loop drift, calibration uncertainties and instrument device uncertainties. The loop drift was considered in developing the technical specification trip setpoint, which is an allowable value calculated per Instrument Society of America Standard ISA-S67.04.

The LTOP MPT enable temperature was developed using the guidance found in NRC Standard Review Plan 5.2.2, Revision 2. The enable temperature was calculated using specific heatup transients with changing thermal rates to reduce the temperature gradients. The selection of the proposed more restrictive heatup rates and the resulting allowable pressure limits as described above were required to minimize the increase in the MPT enable

temperature caused by the higher fluence. The LTOP MPT enable temperature was increased from 327°F to 355°F.

As a result of the higher MPT enable temperature, the transition range at which the HPSI pumps are placed under manual control on cooldown and restored to automatic status on heatup has been changed from 327°F - 350°F to 355°F - 375°F in the technical specifications and bases. Calculations performed indicate that adequate LOCA protection below 375°F is provided by the Safety Injection Tanks. This is sufficient to allow operator action to manually start a HPSI pump, if required.

3. **RCP Start Criteria**

The new PORV setpoint provides margin to accommodate possible pressurization transients after starting two RCPs at the same time. The thermal-hydraulic analysis of RCP start transients simulate thermodynamic conditions within the pressurizer. Calculations have also statistically combined instrumentation uncertainties, providing additional margin in assumed initial conditions for transient analysis. These provide a set of operating conditions which permit normal RCP start without challenging the PORV.

Reference (a) discusses the RCP start transient analysis that was used in developing RCP start criteria (two RCPs started at the same time). Additional analytical margin was available to specify a higher maximum pressurizer pressure and a shorter allowable time after shutdown for the RCP start transient analysis, but was not used. We are now taking credit for this additional margin and have increased the maximum initial indicated pressurizer pressure from 290 psia to 300 psia and have deleted the eight-hour criteria in the bases for the RCP start transient.

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

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

- indicated initial pressurizer level less than or equal to 170 inches. This is not a change from the current limit.

- indicated steam generator secondary temperature no more than 30°F higher than indicated RCS temperature. This is not a change from the current limit.

4. **Mass Addition Transients**

The changes in PORV setpoints and P-T limits affect the existing mass addition transient controls. Lowering the maximum analytical pressurizer pressure from 464.1 psia to 444.5 psia requires lowering the total flow limit into the pressurizer during a mass addition event. The existing throttled HPSI pump flow limit of 210 gpm has been changed to 200 gpm to preclude exceeding the Appendix G limit when adding mass to the RCS.

5. **HPSI Pumps**

The OPERABLE high pressure safety injection pump required in Technical Specification 3/4.4.9.3 must be under manual control when the RCS temperature is less than or equal to 355°F and the RCS is vented to less than 8 square inches. This is currently controlled in plant procedures. The revision to this technical specification ensures that when the HPSI pump is not in use, its handswitch is in pull-to-lock. This revision does not change the intent of technical specification and is added for clarification only.

6. **Technical Specification Bases**

The margin of 80°F between the calculated minimum boltup temperature (-10°F) and the conservative administrative limit (70°F) ensures that actual boltup temperature is consistent with the assumptions of the safety analysis. The conservative administrative limit of 70°F for minimum boltup temperature provides sufficient margin to ensure that instrument uncertainty is not a concern. It has also been clarified that the administrative limit of 70°F for minimum boltup temperature is the minimum allowable reactor vessel temperature at which the reactor vessel head can be attached in order to comply with the 10 CFR Part 50, Appendix G limits. Therefore the discussion of instrument uncertainty in the Bases is not necessary.

The current Bases references a figure that was developed to show the calculated RCS pressure versus time. Since this figure is not included in the Technical Specifications or the Bases, the references to this figure has been removed. A more descriptive discussion has been added that addresses the mass addition transient, which is the basis for the PORV setpoint, and therefore, is more appropriate for the Bases.

DETERMINATION OF SIGNIFICANT HAZARDS

The proposed change has been evaluated against the standards in 10 CFR 50.92 and has been determined to not involve a significant hazards consideration, in that operation of the facility in accordance with the proposed amendment:

1. *Would not involve a significant increase in the probability or consequences of an accident previously evaluated.*

The existing Unit 1 12 Effective Full Power Years (EFPY) Pressure-Temperature (P-T) limits were conservatively developed in accordance with the fracture toughness requirements of 10 CFR 50, Appendix G, as supplemented by the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel 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. Because of increased fluence from 12 EFPY to approximately 22 EFPY based on the current core loading pattern, this amendment changes the P-T limit calculations that are the basis for the existing heatup and cooldown curves. The proposed heatup and cooldown curves and associated limits continue to provide conservative administrative restrictions on reactor coolant system pressure to minimize material stresses in the Reactor Coolant System (RCS) due to normal operating transients, thus minimizing the likelihood of a rapidly propagating fracture due to pressure transients at low temperature. Because these proposed heatup and cooldown curves and rates are based

on new P-T limits that were conservatively developed using the same methods as the existing curves, this proposed amendment does not involve an increase in the probability or consequences of accidents previously evaluated.

Consistent with the selection of proposed heatup and cooldown curves and rates, the low temperature overpressure protection (LTOP) controls are being changed by decreasing the Power Operated Relief Valve (PORV) trip setpoint. The increase in vessel fluence requires that the Minimum Pressure and Temperature (MPT) enable temperature be increased. The new PORV trip setpoint is based on protecting against exceeding 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 will 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.

As a result of the higher MPT enable temperature, the transition region at which the high pressure safety injection (HPSI) pumps are placed under manual control on cooldown and restored to automatic status on heatup has been changed to 355°F - 375°F. Analysis performed indicates that adequate Loss of Coolant Accident (LOCA) protection below 375°F is provided by the Safety Injection Tanks to allow operator action to manually start a HPSI pump, if required. Therefore, this change does not increase the probability or consequences of accidents previously evaluated.

The proposed heatup and cooldown rates, the decreased PORV trip setpoint, and increased MPT enable temperature continue to provide margin to accommodate postulated pressurization from mass and energy addition transients. Calculations have been performed that predict the response to such transients. From these calculations, the Reactor Coolant Pump (RCP) start criteria has been revised. The revised criteria will permit a slightly higher initial pressure for RCP starts (two RCPs starting simultaneously) and will remove the eight-hour reactor shutdown criteria for RCP restart. Also, a lower HPSI pump throttle flow limit has been selected that will continue to protect the Appendix G pressure limit during a mass addition transient. Adding the requirement to ensure the operable HPSI pump's handswitch will be placed in pull-to-lock when not in use is only a clarification and does not change the intent of the specification. Because the results of the analyses remain well within the conservative acceptance limits of 10 CFR 50 Appendix G, these changes do not increase the probability or consequences of accidents previously evaluated.

2. *Would not create the possibility of a new or different type of accident from any accident previously evaluated.*

The proposed changes to LTOP 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.

3. Would not involve a significant reduction in a margin of safety.

This change will ensure that the margin of safety is maintained with respect to energy addition or mass addition events in that there are no postulated events that could challenge the Appendix G limit. Utilizing the analytical margins for a planned RCP start does not significantly reduce the margin of safety. The proposed increase in the allowable fluence at the reactor vessel wall necessitated the changes to the heatup and cooldown curves and rates, the PORV trip setpoint, MPT enable temperature, HPSI pump flow limit, and HPSI pump manual control temperature. These changes ensure that the margin of safety is maintained by protecting the Appendix G limits for all postulated transients. Therefore, the proposed changes would not involve a significant reduction in a margin of safety.

Based on the above, we have concluded that these changes do not constitute a significant hazard.

SCHEDULE

This change is requested to be approved and issued by May 15, 1992 to allow implementation during the upcoming Unit 1 spring 1992 refueling outage. This date will support the scheduled date for installing the pressurizer manway, after which LTOP controls must be in place. Approval of this request after May 15, 1992, may require the PORV setpoint to be changed at power, which we would prefer to avoid. The current curves are expected to expire in December 1992.

SAFETY COMMITTEE REVIEW

These proposed changes 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,

G. C. Creel

STATE OF MARYLAND :
: TO WIT :
COUNTY OF CALVERT :

I hereby certify that on the 6th day of February, 1992, 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 information 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 information on behalf of said Corporation.

WITNESS my Hand and Notarial Seal:

Robin C. Johnson
Notary Public

My Commission Expires:

January 31, 1995
Date

GCC/DJM/djm/dlm

Attachments

cc: D. A. Brune, Esquire
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