September 18, 1990

Docket No. 50-317

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Mr. G. C. Creel
Vice President - Nuclear Energy
Baltimore Gas and Electric Company
Calvert Cliffs Nuclear Power Plant
MD Rts. 2 & 4
P. O. Box 1535
Lusby, Maryland 20657

Dear Mr. Creel:

SUBJECT: ISSUANCE OF AMENDMENT FOR CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT 1 (TAC NO. 77292)

The Commission has issued the enclosed Amendment No. 146 to Facility Operating License No. DPR-53 for the Calvert Cliffs Nuclear Power Plant, Unit No. 1. This amendment consists of changes to the Technical Specifications (TS) in response to your application transmitted by letter dated August 13, 1990.

This amendment modifies the existing 0-12 effective full power year (EFPY) heatup and cooldown curves and rates based on the guidance provided in Regulatory Guide 1.99, Revision 2. In addition, adjustments were made to the low temperature overpressure protection (LTOP) mitigating system including changes to the power operated relief valve (PORV) lift setpoint and the reactor coolant pump (RCP) start controls. The supporting TS Bases were also modified to be consistent with the above TS changes.

A copy of the related Safety Evaluation is enclosed. A Notice of Issuance will be included in the Commission's next regular bi-weekly Federal Register notice.

Sincerely,
ORIGINAL SIGNED BY,
Daniel G. McDonald, Senior Project Manager
Project Directorate I-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosures:
1. Amendment No. 146 to DPR-53
2. Safety Evaluation

cc: w/enclosures
See next page

*See previous concurrence

PDI-1	PDI-1	PDI-1	OGC
CVogan	DMcDonald:rsc	RACapra	LDewey*
9-13-90	9/13/90	9/17/90	9/4/90

DOCUMENT NAME: AMENDMENT TAC 77292

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

September 18, 1990

Docket No. 50-317

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Vice President - Nuclear Energy
Baltimore Gas and Electric Company
Calvert Cliffs Nuclear Power Plant
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See next page

Mr. G. C. Creel
Baltimore Gas & Electric Company

Calvert Cliffs Nuclear Power Plant

cc:

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

BALTIMORE GAS AND ELECTRIC COMPANY

DOCKET NO. 50-317

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 146
License No. DPR-53

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

   A. The application for amendment by Baltimore Gas and Electric Company (the licensee) dated August 13, 1990, 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.

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. DPR-53 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 146, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of the date of its issuance and shall be implemented within 30 days.

FOR THE NUCLEAR REGULATORY COMMISSION

Robert A. Capra

Robert A. Capra, Director
Project Directorate I-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: September 18, 1990

ATTACHMENT TO LICENSE AMENDMENTS

AMENDMENT NO. 146 FACILITY OPERATING LICENSE NO. DPR-53

DOCKET NO. 50-317

Revise Appendix A as follows:

Remove Pages	Insert Pages
3/4 1-8	3/4 1-8
3/4 1-10	3/4 1-10
3/4 3-11	3/4 3-11
3/4 4-1*	3/4 4-1*
3/4 4-2	3/4 4-2
3/4 4-2a	3/4 4-2a
3/4 4-23	3/4 4-23
3/4 4-24	3/4 4-24
3/4 4-24a	3/4 4-24a
3/4 4-26a	3/4 4-26a
3/4 5-4	3/4 5-4
3/4 5-6	3/4 5-6
B 3/4 4-1	3/4 4-1
B 3/4 4-7	3/4 4-7
B 3/4 4-8	3/4 4-8
B 3/4 5-2	3/4 5-2

*Pages that did not change, but are overleaf.

REACTIVITY CONTROL SYSTEMS

3/4.1.2 BORATION SYSTEMS

FLOW PATHS - SHUTDOWN

LIMITING CONDITION FOR OPERATION

3.1.2.1 As a minimum, one of the following boron injection flow paths and one associated heat tracing circuit shall be **OPERABLE**:

a. A flow path from the boric acid storage tank via either a boric acid pump or a gravity feed connection and charging pump to the Reactor Coolant System if only the boric acid storage tank in Specification 3.1.2.7a is **OPERABLE**, or

b. The flow path from the refueling water tank via either a charging pump or a high pressure safety injection pump* to the Reactor Coolant System if only the refueling water tank in Specification 3.1.2.7b is **OPERABLE**.

APPLICABILITY: **MODES 5 AND 6.**

ACTION:

With none of the above flow paths **OPERABLE**, suspend all operations involving **CORE ALTERATIONS** or positive reactivity changes until at least one injection path is restored to **OPERABLE** status.

SURVEILLANCE REQUIREMENTS

4.1.2.1 At least one of the above required flow paths shall be demonstrated **OPERABLE**:

a. At least once per 7 days by verifying that the temperature of the heat traced portion of the flow path is above the temperature limit line shown on Figure 3.1-1 when a flow path from the concentrated boric acid tanks is used.

b. At least once per 31 days by verifying that each valve (manual, power operated or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

* At 327°F and less, the required **OPERABLE** HPSI pump shall be in pull-to-lock and will not start automatically. At 327°F and less, HPSI pump use will be conducted in accordance with Technical Specification 3.4.9.3.

REACTIVITY CONTROL SYSTEMS

CHARGING PUMP - SHUTDOWN

LIMITING CONDITION FOR OPERATION

3.1.2.3 At least one charging pump or one high pressure safety injection pump* in the boron injection flow path required **OPERABLE** pursuant to Specification 3.1.2.1 shall be **OPERABLE** and capable of being powered from an **OPERABLE** emergency bus.

APPLICABILITY: **MODES** 5 and 6.

ACTION:

With no charging pump or high pressure safety injection pump **OPERABLE**, suspend all operations involving **CORE ALTERATIONS** or positive reactivity changes until at least one of the required pumps is restored to **OPERABLE** status.

SURVEILLANCE REQUIREMENTS

4.1.2.3 No additional Surveillance Requirements other than those required by Specification 4.0.5.

* At 327°F and less, the required **OPERABLE** HPSI pump shall be in pull-to-lock and will not start automatically. At 327°F and less, HPSI pump use will be conducted in accordance with Technical Specification 3.4.9.3.

TABLE 3.3-3

ENGINEERED SAFETY FEATURE ACTUATION SYSTEM INSTRUMENTATION

FUNCTIONAL UNIT	TOTAL NO. OF CHANNELS	CHANNELS TO TRIP	MINIMUM CHANNELS OPERABLE	APPLICABLE MODES	ACTION
1. SAFETY INJECTION (SIAS)@					
a. Manual (Trip Buttons)	2	1	2	1, 2, 3, 4	6
b. Containment Pressure - High	4	2	3	1, 2, 3	7*
c. Pressurizer Pressure - Low	4	2	3	1, 2, 3(a)	7*
2. CONTAINMENT SPRAY (CSAS)					
a. Manual (Trip Buttons)	2	1	2	1, 2, 3, 4	6
b. Containment Pressure - High	4	2	3	1, 2, 3	11
3. CONTAINMENT ISOLATION (CIS)#					
a. Manual CIS (Trip Buttons)	2	1	2	1, 2, 3, 4	6
b. Containment Pressure - High	4	2	3	1, 2, 3	7*

Containment isolation of non-essential penetrations is also initiated by SIAS (functional units 1.a and 1.c).

@ When the RCS temperature is:
(a) Greater than 350°F, the required OPERABLE HPSI pumps must be able to start automatically upon receipt of a SIAS signal,
(b) Between 350°F and 327°F, a transition region exists where the OPERABLE HPSI pump will be placed in pull-to-lock on a cooldown and restored to automatic status on a heatup,
(c) At 327°F and less, the required OPERABLE HPSI pump shall be in pull-to-lock and will not start automatically.

3/4.4 REACTOR COOLANT SYSTEM

COOLANT LOOPS AND COOLANT CIRCULATION

STARTUP AND POWER OPERATION

LIMITING CONDITION FOR OPERATION

3/4.1.1 Both reactor coolant loops and both reactor coolant pumps in each loop shall be in operation.

APPLICABILITY: **MODES** 1 and 2*.

ACTION:

With less than the above required reactor coolant pumps in operation, be in at least **HOT STANDBY** within 1 hour.

SURVEILLANCE REQUIREMENTS

4.4.1.1 The above required reactor coolant loops shall be verified to be in operation and circulating reactor coolant at least once per 12 hours.

---

* See Special Test Exception 3.10.3.

REACTOR COOLANT SYSTEM

COOLANT LOOPS AND COOLANT CIRCULATION

HOT STANDBY

LIMITING CONDITION FOR OPERATION

3.4.1.2 a. The reactor coolant loops listed below shall be **OPERABLE**:

1. Reactor Coolant Loop #11 and at least one associated reactor coolant pump.

2. Reactor Coolant Loop #12 and at least once associated reactor coolant pump.

b. At least one of the above Reactor Coolant Loops shall be in operation*.

APPLICABILITY: **MODE 3****

ACTION:

a. With less than the above required reactor coolant loops **OPERABLE**, restore the required loops to **OPERABLE** status within 72 hours or be in **HOT SHUTDOWN** within the next 12 hours.

b. With no reactor coolant loop in operation, suspend all operations involving a reduction in boron concentration of the Reactor Coolant System and initiate corrective action to return the required loop to operation within one hour.

SURVEILLANCE REQUIREMENTS

4.4.1.2.1 At least the above required reactor coolant pumps, if not in operation, shall be determined to be **OPERABLE** once per 7 days by verifying correct breaker alignments and indicated power availability.

4.4.1.2.2 At least one cooling loop shall be verified to be in operation and circulating reactor coolant at least once per 12 hours.

---

* All reactor coolant pumps may be de-energized for up to 1 hour (up to 2 hours for low flow test) provided (1) no operations are permitted that would cause dilution of the reactor coolant system boron concentration, and (2) core outlet temperature is maintained at least $10^{o}F$ below saturation temperature.

** A reactor coolant pump shall not be started with the RCS temperature less than or equal to $327^{o}F$ unless (1) the pressurizer water level is less than or equal to 170 inches and (2) the secondary water temperature of each steam generator is less than or equal to $30^{o}F$ above the RCS temperature, and (3) the pressurizer pressure is less than or equal to 290 psia.

COOLANT LOOPS AND COOLANT CIRCULATION

SHUTDOWN

LIMITING CONDITION FOR OPERATION

3.4.1.3

a. At least two of the coolant loops listed below shall be **OPERABLE:**

1. Reactor Coolant Loop #11 and its associated steam generator and at least one associated reactor coolant pump.

2. Reactor Coolant Loop #12 and its associated steam generator and at least one associated reactor coolant pump,

3. Shutdown Cooling Loop #11*,

4. Shutdown Cooling Loop #12*.

b. At least one of the above coolant loops shall be in operation**.

APPLICABILITY: **MODES 4*** and 5*****.

ACTION:

a. With less than the above required coolant loops **OPERABLE**, initiate corrective action to return the required coolant loops to **OPERABLE** status within one hour or be in **COLD SHUTDOWN** within 24 hours.

b. With no coolant loop in operation, suspend all operations involving a reduction in boron concentration of the Reactor Coolant System and initiate corrective action to return the required coolant loop to operation within one hour.

---

* The normal or emergency power source may be inoperable in MODE 5.

** All reactor coolant pumps and shutdown cooling pumps may be de-energized for up to 1 hour provided (1) no operations are permitted that would cause dilution of the reactor coolant system boron concentration, and (2) core outlet temperature is maintained at least 10^{0}F below saturation temperature.

*** A reactor coolant pump shall not be started with the RCS temperature less than or equal to 327^{0}F unless (1) the pressurizer water level is less than or equal to 170 inches, and (2) the secondary water temperature of each steam generator is less than or equal to 30^{0}F above the RCS temperature, and (3) the pressurizer pressure is less than or equal to 290 psia.

\# See Special Test Exception 3.10.5.

REACTOR COOLANT SYSTEM

3/4.4.9 PRESSURE/TEMPERATURE LIMITS

REACTOR COOLANT SYSTEM

LIMITING CONDITION FOR OPERATION

3.4.9.1 The Reactor Coolant System (except the pressurizer) temperature and pressure shall be limited in accordance with the limit lines shown on Figure 3.4-2 during heatup, cooldown, criticality, and inservice leak and hydrostatic testing with:

a. A maximum heatup of:

Maximum Allowable Heatup Rate	RCS Temperature
40°F in any one hour period	70°F to 313°F
10°F in any one hour period	314°F to 327°F
60°F in any one hour period	> 327°F

b. A maximum cooldown of:

Maximum Allowable Cooldown Rate	RCS Temperature
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

c. A maximum temperature change of 5°F in any one hour period, during hydrostatic testing operations above system design pressure.

APPLICABILITY: At all times.

ACTION:

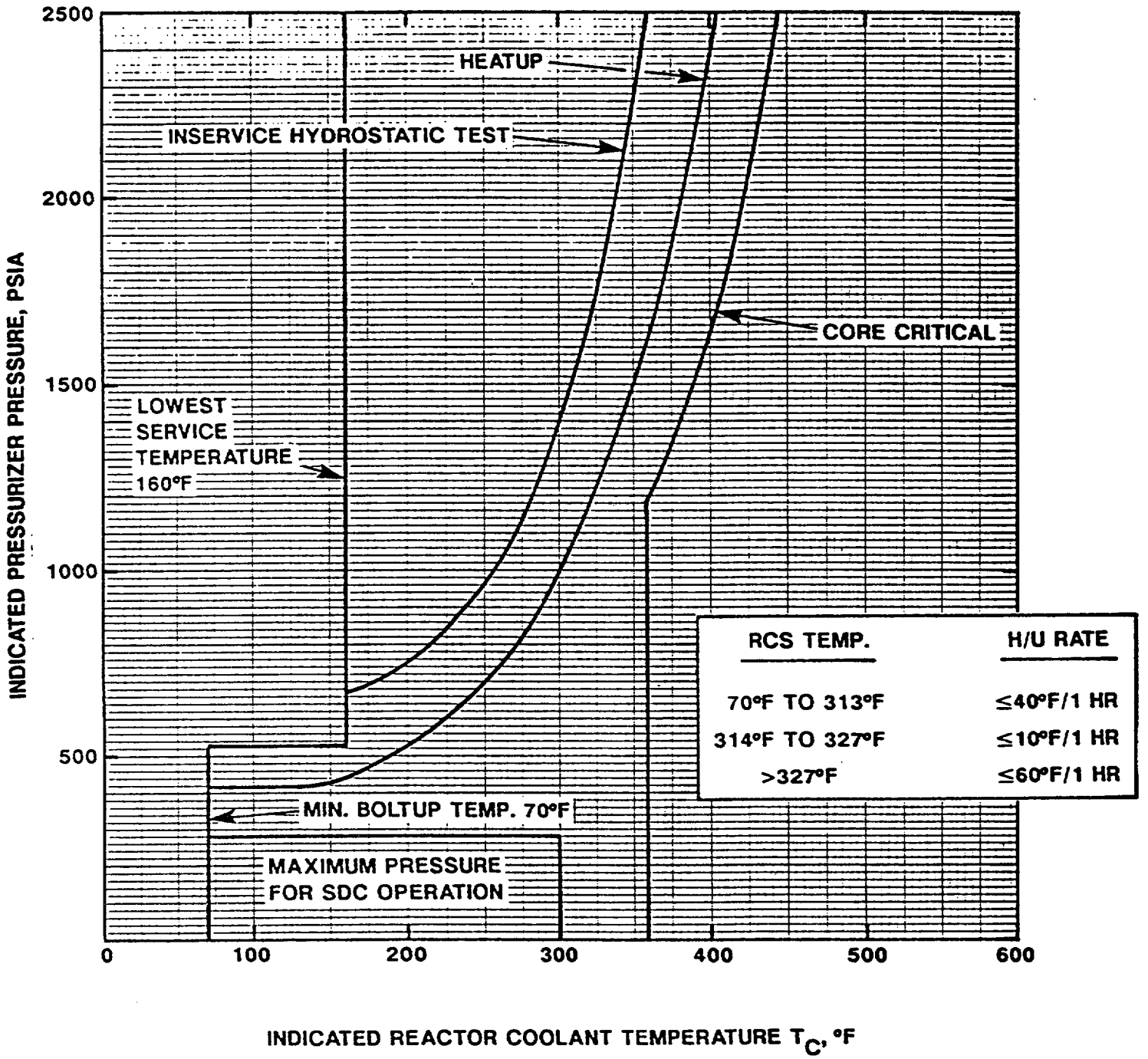
With any of the above limits exceeded, restore the temperature and/or pressure to within the limit within 30 minutes; perform an engineering evaluation to determine the effects of the out-of-limit condition on the fracture toughness properties of the Reactor Coolant System; determine that the Reactor Coolant System remains acceptable for continued operations or be in at least HOT STANDBY within the next 6 hours and reduce the RCS T_{avg} and pressure to less than 200°F and 300 psia, respectively, within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.4.9.1.1 The Reactor Coolant System temperature and pressure shall be determined to be within the limits at least once per 30 minutes during system heatup, cooldown, and inservice leak and hydrostatic testing operations.

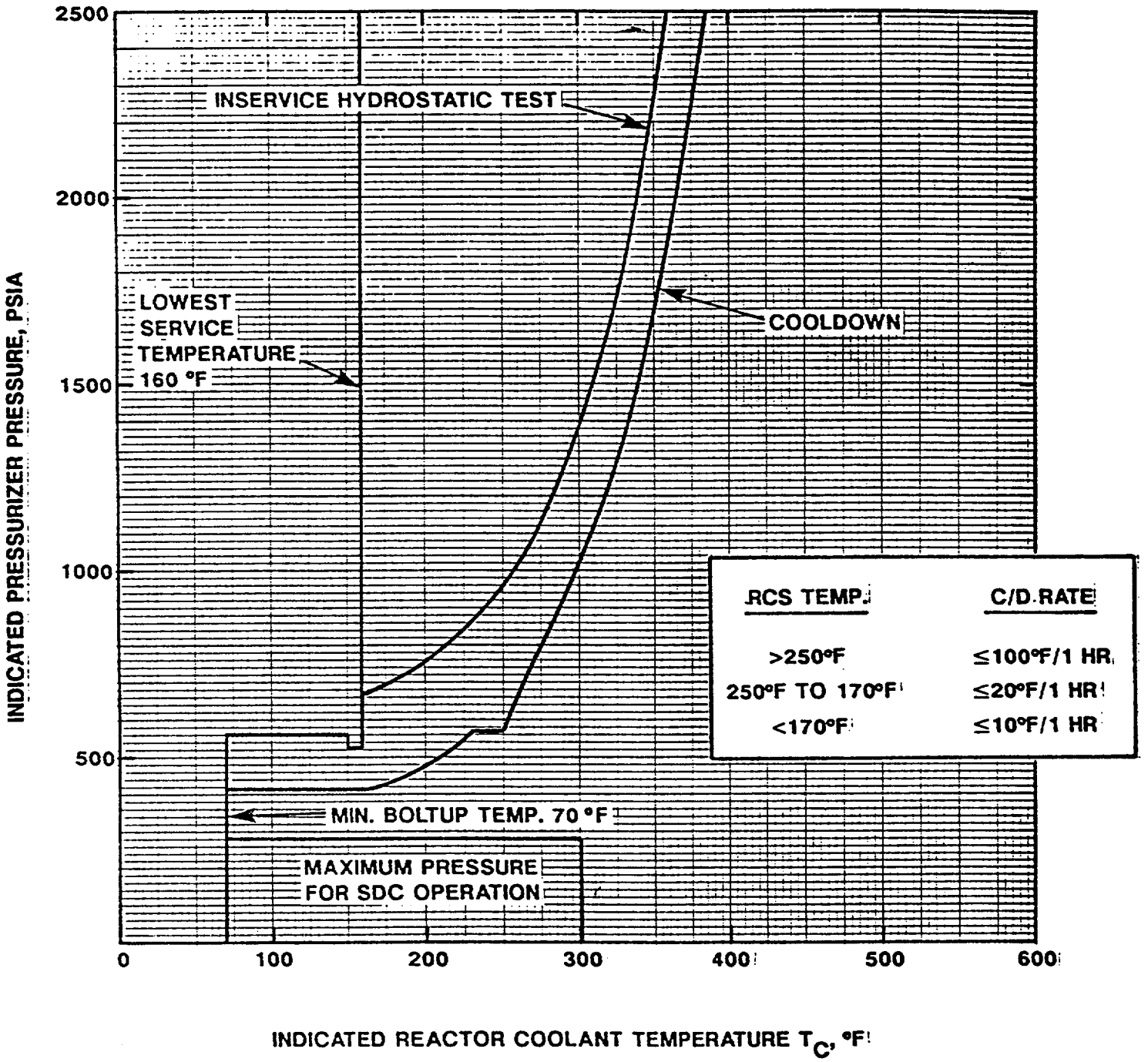
4.4.9.1.2 The reactor vessel material irradiation surveillance specimens shall be removed and examined, to determine changes in material properties, at the intervals shown in Table 4.4-5. The results of these examinations shall be used to update Figure 3.4-2.

FIGURE 3.4-2a
CALVERT CLIFFS UNIT 1 HEATUP CURVE, 12 EFPY
REACTOR COOLANT SYSTEM PRESSURE TEMPERATURE LIMITS



* The minimum boltup temperature is the temperature of the reactor vessel flange, not the coolant temperature

FIGURE 3.4-2b
CALVERT CLIFFS UNIT 1 COOLDOWN CURVE, 12 EFPY
REACTOR COOLANT SYSTEM PRESSURE TEMPERATURE LIMITS



* The minimum boltup temperature is the temperature of the reactor vessel flange, not the coolant temperature

REACTOR COOLANT SYSTEM

OVERPRESSURE PROTECTION SYSTEMS

LIMITING CONDITION FOR OPERATION

3.4.9.3 The following overpressure protection requirements shall be met:

a. One of the following three overpressure protection systems shall be in place:

1. Two power-operated relief valves (PORVs) with a lift setting $\leq$ 430 psia or
2. A single PORV with a lift setting of $\leq$ 430 psia and a Reactor Coolant System vent of $\geq$ 1.3 square inches, or
3. A Reactor Coolant System (RCS) vent $\geq$ 2.6 square inches.

b. Two high pressure safety injection (HPSI) pumps# shall be disabled by either removing (racking out) their motor circuit breakers from the electrical power supply circuit, or by locking shut their discharge valves.

c. The HPSI loop motor operated valves (MOVs)# shall be prevented from automatically aligning HPSI pump flow to the RCS by placing their hand switches in pull-to-override.

d. No more than one OPERABLE high pressure safety injection pump with suction aligned to the Refueling Water Tank may be used to inject flow into the RCS and when used, it must be under manual control and one of the following restrictions shall apply:

1. The total high pressure safety injection flow shall be limited to $\leq$ 210 gpm **OR**
2. A reactor coolant system vent of $\geq$ 2.6 square inches shall exist.

APPLICABILITY: When the RCS temperature is $\leq$ 327°F and the RCS is vented to < 8 square inches.

ACTION:

a. With one PORV inoperable, either restore the inoperable PORV to OPERABLE status within 5 days or depressurize and vent the RCS through a $\geq$ 1.3 square inch vent(s) within the next 48 hours; maintain the RCS in a vented condition until both PORVs have been restored to OPERABLE status.

b. With both PORVs inoperable, depressurize and vent the RCS through a $\geq$ 2.6 square inch vent(s) within 48 hours; maintain the RCS in a vented condition until either one OPERABLE PORV and a vent of $\geq$ 1.3 square inches has been established or both PORVs have been restored to OPERABLE status.

EXCEPT when required for testing.

SURVEILLANCE REQUIREMENTS

4.5.2 Each ECCS subsystem shall be demonstrated **OPERABLE***:

a. At least once per 12 hours by verifying that the following valves are in the indicated positions with power to the valve operators removed:

Valve Number	Valve Function	Valve Position
1. MOV-659	Mini-flow Isolation	Open
2. MOV-660	Mini-flow Isolation	Open
3. CV-306	Low Pressure SI Flow Control	Open

b. At least once per 31 days by:

1. Verifying that upon a Recirculation Actuation Test Signal, the containment sump isolation valves open.

2. Verifying that each valve (manual, power operated or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

c. By a visual inspection which verifies that no loose debris (rags, trash, clothing, etc.) is present in the containment which could be transported to the containment sump and cause restriction of the pump suctions during LOCA conditions. This visual inspection shall be performed:

1. For all accessible areas of the containment prior to establishing **CONTAINMENT INTEGRITY**, and

2. Of the areas affected within containment at the completion of containment entry when **CONTAINMENT INTEGRITY** is established.

d. Within 4 hours prior to increasing the RCS pressure above 1750 psia by verifying, via local indication at the valve, that CV-306 is open.

---

* Whenever flow testing into the RCS is required at RCS temperatures of 327^{o}F and less, the high pressure safety injection pump shall recirculate RCS water (suction from RWT isolated) or the controls of Technical Specification 3.4.9.3 shall apply.

EMERGENCY CORE COOLING SYSTEMS

ECCS SUBSYSTEMS - T_{avg} < 300°F

LIMITING CONDITION FOR OPERATION

3.5.3 As a minimum, one ECCS subsystem comprised of the following shall be OPERABLE:

a. One# OPERABLE high-pressure safety injection pump, and

b. An OPERABLE flow path capable of taking suction from the refueling water tank on a Safety Injection Actuation Signal and automatically transferring suction to the containment sump on a Recirculation Actuation Signal.

APPLICABILITY: MODES 3* and 4.

ACTION:

a. With no ECCS subsystem OPERABLE, restore at least one ECCS subsystem to OPERABLE status within 1 hour or be in COLD SHUTDOWN within the next 20 hours.

b. In the event the ECCS is actuated and injects water into the Reactor Coolant System, a Special Report shall be prepared and submitted to the Commission pursuant to Specification 6.9.2 within 90 days describing the circumstances of the actuation and the total accumulated actuation cycles to date.

SURVEILLANCE REQUIREMENTS

4.5.3.1 The ECCS subsystem shall be demonstrated OPERABLE per the applicable Surveillance Requirements of 4.5.2.

* With pressurizer pressure < 1750 psia.

\# Between 350°F and 327°F, a transition region exists where the OPERABLE HPSI pump will be placed in pull-to-lock on a cooldown and restored to automatic status on a heatup. At 327°F and less, the required OPERABLE HPSI pump shall be in pull-to-lock and will not start automatically. At 327°F and less, HPSI pump use will be conducted in accordance with Technical Specification 3.4.9.3.

3/4.4.1 COOLANT LOOPS AND COOLANT CIRCULATION

The plant is designed to operate with both reactor coolant loops and associated reactor coolant pumps in operation, and maintain DNBR above 1.195 during all normal operations and anticipated transients.

A single reactor coolant loop with its steam generator filled above the low level trip setpoint provides sufficient heat removal capability for core cooling while in MODES 2 and 3; however, single failure considerations require plant shutdown if component repairs and/or corrective actions cannot be made within the allowable out-of-service time.

In MODES 4 and 5, a single reactor coolant loop or shutdown cooling loop provides sufficient heat removal capability for removing decay heat; but single failure considerations require that at least two loops be OPERABLE. Thus, if the reactor coolant loops are not OPERABLE, this specification requires two shutdown cooling loops to be OPERABLE.

The operation of one Reactor Coolant Pump or one shutdown cooling pump provides adequate flow to ensure mixing, prevent stratification and produce gradual reactivity changes during boron concentration reductions in the Reactor Coolant System. The reactivity change rate associated with boron reductions will, therefore, be within the capability of operator recognition and control.

The restrictions on starting a Reactor Coolant Pump during MODES 3, 4 and 5 with the RCS temperature $\leq 327^{o}F$ are provided to prevent RCS pressure transients, caused by energy additions from the secondary system, which could exceed the limits of Appendix G to 10 CFR Part 50 (see Bases 3/4.4.9). For operation of the reactor coolant pumps the following criteria apply: (1) restricting the water volume in the pressurizer (170 inches) and thereby providing a volume for the primary coolant to expand into and (2) by restricting starting of the RCPs to when the indicated secondary water temperature of each steam generator is less than or equal to $30^{o}F$ above the Reactor Coolant System temperature, (3) limit the initial indicated pressure of the pressurizer to less than or equal to 290 psia.

3/4.4.2 SAFETY VALVES

The pressurizer code safety valves operate to prevent the RCS from being pressurized above its Safety Limit of 2750 psia. Each safety valve is designed to relieve approximately 3×10^{5} lbs per hour of saturated steam at the valve setpoint. The relief capacity of a single safety valve is adequate to relieve any overpressure condition which could occur during shutdown. In the event that no safety valves are OPERABLE, an operating shutdown cooling loop, connected to the RCS, provides overpressure relief capability and will prevent RCS overpressurization.

During operation, all pressurizer code safety valves must be OPERABLE to prevent the RCS from being pressurized above its safety limit of 2750 psia. The combined relief capacity of these valves is sufficient to

The minimum boltup temperature is the minimum allowable temperature at pressures below 20% of the pre-operational system hydrostatic test pressure. The minimum is defined as the initial RT_{NDT} for the material of the higher stressed region of the reactor vessel plus any effects for irradiation per Article G-2222 of Section III of the ASME Boiler and Pressure Vessel Code. The initial reference temperature of the reactor vessel and closure head flanges was determined using the certified material test reports and Branch Technical Position MTEB 5-2. The maximum initial RT_{NDT} associated with the stressed region of the closure head flange is $-10^{0}F$. The minimum boltup temperature including temperature instrument uncertainty is $-10^{0}F + 10^{0}F = 0^{0}F$. However, for conservatism, a minimum boltup temperature of $70^{0}F$ is utilized.

The design basis events in the low temperature region assuming a water solid system are:

- A RCP start with hot steam generators; and,
- An inadvertent HPSI actuation with concurrent charging.

Any measures which will prevent or mitigate the design basis events are sufficient for any less severe incidents. Therefore, this section will discuss the results of the RCP start and mass addition transient analyses. Also discussed is the effectiveness of a pressurizer steam bubble and a single PORV relative to mitigating the design basis events.

The RCP start transient is a severe LTOP challenge for a water solid RCS. Therefore, during water solid operations all 4 RCPs are tagged out of service. Analysis indicates the transient is adequately controlled by placing restrictions on three parameters: initial pressurizer pressure and level, and the secondary-to-primary temperature difference. With these restrictions in place and when decay heat level is low (reactor has been shutdown 8 hours or longer), the transient is adequately controlled without the assistance of the PORVs. Operating procedures require that during normal cooldowns, entry into MPT enable ($327^{0}F$ and below) will not occur until 8 hours after reactor shutdown. This restriction is not intended to delay cooldown in situations where plant or personnel safety considerations make expeditious cooldown prudent. If RCPs are restored in response to a loss of decay heat removal when decay heat loads are high and operator actions were either not taken or ineffective, a single PORV will protect the Appendix G limits.

The inadvertent actuation of one HPSI pump in conjunction with one charging pump is the most severe mass addition overpressurization event. Analyses were performed for a single HPSI pump and one charging pump assuming one PORV available with the existing orifice area of 1.29 in^2. For the limiting case, only a single PORV is considered available due to single failure criteria. A figure was developed which shows the calculated RCS pressures versus time that will occur assuming HPSI and charging pump mass inputs, and the expansion of the RCS following loss of decay heat removal. Sufficient overpressure protection results when the equilibrium pressure does not exceed the limiting Appendix G curve pressure. Because the equilibrium pressure

exceeds the minimum Appendix G limit for full HPSI flow, HPSI flow is throttled to no more than 210 gpm indicated when the HPSI pump is used for mass addition. The HPSI flow limit includes allowances for instrumentation uncertainty, charging pump flow addition and RCS expansion following loss of decay heat removal. The HPSI flow is injected through only one HPSI loop MOV to limit instrumentation uncertainty. No more than one charging pump (44 gpm) is allowed to operate during the HPSI mass addition.

Comparison of the PORV discharge curve with the critical pressurizer pressure of 464.1 psia indicates that adequate protection is provided by a single PORV for RCS temperatures of $70^{o}F$ or above when all mass input is limited to 380 gpm. HPSI discharge is limited to 210 gpm to allow for one charging pump and system expansion due to loss of decay heat removal.

To provide single failure protection against a HPSI pump mass addition transient, the HPSI loop MOV handswitches must be placed in pull-to-override so the valves do not automatically actuate upon receipt of a SIAS signal. Alternative actions, described in the ACTION STATEMENT, are to disable the affected MOV (by racking out its motor circuit breaker or equivalent), or to isolate the affected HPSI header. Examples of HPSI header isolation actions include; (1) de-energizing and tagging shut the HPSI header isolation valves; (2) locking shut and tagging all three HPSI pump discharge MOVs; and (3) disabling all three HPSI pumps.

Three 100% capacity HPSI pumps are installed at Calvert Cliffs. Procedures will require that two of the three HPSI pumps be disabled (breakers racked out) at RCS temperatures less than or equal to $327^{o}F$ and that the remaining HPSI pump handswitch be placed in pull-to-lock. Additionally, the HPSI pump normally in pull-to-lock shall be throttled to less than or equal to 210 gpm when used to add mass to the RCS. Exceptions are provided for ECCS testing and for response to LOCAs.

A pressurizer steam volume and a single PORV will provide satisfactory control of all mass addition transients with the exception of a spurious actuation of full flow from a HPSI pump. Overpressurization due to this transient will be precluded for temperatures $327^{o}F$ and less by disabling two HPSI pumps, placing the third in pull-to-lock, and by throttling the third pump to less than or equal to 210 gpm flow when it is used to add mass to the RCS.

Note that only the design bases events are discussed in detail since the less severe transients are bounded by the RCP start and inadvertent HPSI actuation analysis.

RCS temperature, as used in the applicability statement, is determined as follows: (1) with the RCPs running, the RCS cold leg temperature is the appropriate indication, (2) with the shutdown cooling system in operation, the shutdown cooling temperature indication is appropriate, (3) if neither the RCPs or shutdown cooling is in operation, the core exit thermocouples are the appropriate indicators of RCS temperature.

The trisodium phosphate dodecahydrate (TSP) stored in dissolving baskets located in the containment basement is provided to minimize the possibility of corrosion cracking of certain metal components during operation of the ECCS following a LOCA. The TSP provides this protection by dissolving in the sump water and causing its final pH to be raised to $\geq$ 7.0. The requirement to dissolve a representative sample of TSP in a sample of RWT water provides assurance that the stored TSP will dissolve in borated water at the postulated post LOCA temperatures.

The Surveillance Requirements provided to ensure OPERABILITY of each component ensure that as a minimum, the assumptions used in the safety analyses are met and the subsystem OPERABILITY is maintained. The surveillance requirement for flow balance testing provides assurance that proper ECCS flows will be maintained in the event of a LOCA. Maintenance of proper flow resistance and pressure drop in the piping system to each injection point is necessary to: (1) prevent total pump flow from exceeding runout conditions when the system is in its minimum resistance configuration, (2) provide the proper flow split between injection points in accordance with the assumptions used in the ECCS-LOCA analyses, and (3) provide an acceptable level of total ECCS flow to all injection points equal to or above that assumed in the ECCS-LOCA analyses. Minimum HPSI flow requirements for temperatures above 327^{o}F are based upon small break LOCA calculations which credit charging pump flow following an SIAS. Surveillance testing includes allowances for instrumentation and system leakage uncertainties. The 470 gpm requirement for minimum HPSI flow from the three lowest flow legs includes instrument uncertainties but not system check valve leakage. The OPERABILITY of the charging pumps and the associated flow paths is assured by the Boration System Specification 3/4.1.2. Specification of safety injection pump total developed head ensures pump performance is consistent with safety analysis assumptions.

At temperatures of 327^{o}F and less, HPSI injection flow is limited to less than or equal to 210 gpm except in response to excessive reactor coolant leakage. With excessive RCS leakage (LOCA), make-up requirements could exceed 210 gpm. Overpressurization is prevented by controlling other parameters, such as RCS pressure and subcooling. This provides overpressure protection in the low temperature region. An analysis has been performed which shows this flow rate is more than adequate to meet core cooling safety analysis assumptions. HPSIs are not required to auto-start when the RCS is in the MPT enable condition. The Safety Injection Tanks provide immediate injection of borated water into the core in the event of an accident, allowing adequate time for an operator to take action to start a HPSI.

Surveillance testing of HPSI pumps is required to ensure pump operability. Some surveillance testing requires that the HPSI pumps deliver flow to the RCS. To allow this testing to be done without increasing the potential for overpressurization of the RCS, either the RWT must be isolated or the HPSI pump flow must be limited to less than or equal to 210 gpm or an RCS vent greater than 2.6 square inches must be provided.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 146 TO FACILITY OPERATING LICENSE NO. DPR-53

BALTIMORE GAS AND ELECTRIC COMPANY

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT 1

DOCKET NO. 50-317

1.0 INTRODUCTION

By letter dated August 13, 1990, the Baltimore Gas and Electric Company (the licensee) proposed to amend the Technical Specifications of the Calvert Cliffs Nuclear Power Plant, Unit 1. In its submittal, the licensee provided Technical Specification (TS) changes to support 10 CFR Part 50, Appendix G, heatup and cooldown curves and rates based on the guidance provided in Regulatory Guide 1.99, Revision 2. In addition, adjustments were made to the low temperature overpressure protection (LTOP) mitigating system including changes to the power operated relief valve (PORV) lift setpoint and the reactor coolant pump (RCP) start controls. The supporting TS Bases were also modified to be consistent with the above TS changes.

2.0 BACKGROUND

By letter dated July 24, 1990, the Commission issued Amendment No. 145 to Facility Operating License DPR-53 for Calvert Cliffs Unit 1. The amendment replaced the existing heatup and cooldown curves with the current 0-12 effective full power year (EFPY) heatup and cooldown curves. In addition, new controls were implemented to establish adequate LTOP. These included: (1) adjustments to the LTOP mitigating system; i.e., the PORV pressure lift setting and enable temperature; (2) changes to the RCP controls; (3) changes to clarify high pressure safety injection (HPSI) operability requirements; and (4) modifications to the HPSI pump controls.

The RCP controls, unlike the other controls, 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 work while analyses were completed for long-term RCP controls. The analysis of long-term requirements for the control of RCP starts was completed by the licensee. The results indicate that only modest adjustments to the current controls are required to still be effective in the mitigation of energy addition transients when LTOP is required. Accordingly, the licensee is proposing the changes previously described. These changes are required prior to entry into Mode 2 Startup.

The specific TS changes proposed for the heatup and cooldown curves and rates; LTOP controls; RCP start criteria; and revised Bases sections to support the changes are the subject of this safety evaluation (SE).

3.0 EVALUATION - APPENDIX G HEATUP AND COOLDOWN CURVES AND RATES

The licensee's calculation of the adjusted nil-ductility reference temperature was based on Regulatory Guide 1.99, Revision 2. The staff determined, in its supporting SE for Amendment No. 145 to the Calvert Cliffs, Unit 1, license discussed above, that the proposed pressure/temperature (P/T) limits for the reactor coolant system heatup, cooldown, inservice hydrostatic test, leak test and criticality are valid through 12 EFPY because the limits conform to the requirements of Appendices G and H of 10 CFR Part 50.

For this review the staff used the same reference temperature from the previous review and SRP 5.3.2 to verify the proposed P/T limits. The licensee changed the heatup rate from 60°F/hr to 40°F/hr for the reactor coolant temperature that ranges from 70°F to 313°F. The cooldown rate was changed from 20°F/hr to 10°F/hr when the reactor coolant temperature is less than 170°F. The proposed P/T limits with these changes are within the allowable limits of SRP 5.3.2. Hence, the proposed P/T limits, TS 3.4.9, TS Figures 3.4-2a, and 3.4-2b are acceptable and may be incorporated into the Calvert Cliffs, Unit 1, TS.

4.0 EVALUATION - LTOP

In its supporting SE for Amendment No. 145, the staff used the following NRC regulations and guidance: Appendices G and H to 10 CFR Part 50; the American Society of Testing Materials (ASTM) Standards and the American Society of Mechanical Engineers (ASME) Code, which are referenced in Appendices G and H; 10 CFR 50.36(c)(2); RG 1.99, Rev. 2; Standard Review Plan (SRP) Sections 5.2.2 and 5.3.2; and Generic Letter 88-11. These regulations and guidance also apply to the current amendment request. In addition, the conclusions drawn in Amendment No. 145 relative to the approved analytical methods remain applicable.

The proposed LTOP TS changes required that new analyses be performed at the higher decay heat loads that exist shortly after a reactor shutdown subsequent to power operation. The RCP start controls implemented in Amendment No. 145 only applied to the current low decay heat condition (shutdown greater than 60 days). The licensee has completed the required analyses and has proposed new RCP start controls, in conjunction with revised pressure-temperature limits and a higher PORV setpoint, to prevent challenges to the PORVs during planned RCP starts under the conditions of higher decay heat loads. In addition, 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.

Only the energy addition transient analysis is affected by the assumed higher decay heat load. The mass addition transient analyses are not affected by the new assumption; thus, the mass addition controls are not changed from those approved in Amendment No. 145. These controls were a modification to High Pressure Safety Injection (HPSI) pump controls when in LTOP conditions.

The LTOP enable temperature (MPT enable) was originally developed using the guidance found in NRC SRP Section 5.2.2, Revision 2. The value of 327°F for the enable temperature was approved in License Amendment No. 145. The enable temperature is not affected by the change in decay heat level assumed in the energy addition transient analyses. Therefore, no change in the previously approved enable temperature is required.

New 12 EFPY P/T heatup and cooldown curves have been developed to replace those approved in Amendment No. 145. To accommodate the more restrictive P/T limits resulting from consideration of Regulatory Guide 1.99, Revision 2, a new LTOP pressure setpoint, and new heatup and cooldown rates are proposed. The revised LTOP setpoint and the heatup and cooldown rates were chosen to: (1) ensure that given a limiting mass or energy input to the reactor coolant system (RCS) during normal operations, anticipated operational occurrences and system hydrostatic testing, the Appendix G P/T limits are not challenged, and (2) ensure that operational flexibility is maintained. In order to accomplish this, the LTOP PORV pressure setpoint will be increased, and in general heatup and cooldown will be slowed, i.e., the rates reduced, for specified RCS temperature ranges. Some changes to RCP start criteria are required to reflect plant conditions which must be satisfied to avoid challenging the PORVs.

The PORV pressure setpoint is commonly set by two design criteria. These are the limiting transients for mass addition and energy addition. Only the limiting energy addition transient is affected by this amendment request. The limiting energy addition transient is the startup of a RCP while steam generator secondary temperature is greater than the primary coolant temperature. This transient was reanalyzed assuming a decay heat level applicable to operation to Mode 2 and above. A RCP startup in one loop with a steam generator primary to secondary temperature difference equal to 30°F and a bubble in the pressurizer was modeled by the licensee using the RETRAN computer code and the calculated results demonstrated that the peak pressure would be less than the PORV lift setpoint. The current Calvert Cliffs TS specify conditions under which a reactor coolant pump may not be started, which include conditions corresponding to LTOP. To be within the limiting condition, the pressurizer indicated water level is administratively controlled to maintain an adequate steam bubble for mitigating the energy addition transient and the startup of a RCP is allowed only when the secondary temperature of each steam generator is less than or equal to 30°F above the RCS temperature. Revisions to numerical values in the applicable TS have been proposed to be consistent with the assumptions in the reanalysis of the RCP startup transient.

For a RCS temperature at or below 327°F, the anticipated LTOP transients may be adequately mitigated by the automatic action of the pressurizer PORVs or by allowing sufficient time for operator response. Based on the results of the reanalysis of the energy addition transient, the licensee proposed TS PORV setpoint is less than or equal to 430 psia. The licensee's proposed PORV setpoint in TS 3.4.9.3, the heatup and cooldown rates identified by proposed TS 3.4.9.1, and the associated Bases section reflect the above discussed LTOP considerations. The staff finds that they are based on approved regulatory guidance, are reasonably conservative, and are therefore acceptable.

The licensee provided its updated P/T curves in proposed TS Figure 3.4-2a (for heatup) and Figure 3.4-2b (for cooldown). The necessary adjustments of LTOP controls are as follows:

Technical Specification 3.4.9.1, "Reactor Coolant System Pressure/Temperature Limits," provide LCOs for acceptable heatup and cooldown rates based on an average RCS temperature limit (T_{avg}). The maximum heatup rate in LCO 3.4.9.1.a has been lowered from 60°F in any one hour period to a proposed rate of 40°F per hour with T_{avg} in the range 70°F to 313°F and 10°F per hour with T_{avg} in the range 314°F to 327°F. The cooldown rate in LCO 3.4.9.1.b is lowered from 20°F per hour to 10°F per hour when RCS temperature is below 170°F. These changes are necessary as a result of the new P/T limit curves for 12 EFPY and the supporting Appendix G analyses. They are acceptable based on the use of approved NRC guidance in the Regulatory Guide 1.99, Revision 2, as previously noted.

Technical Specification 3.4.9.3, "Overpressure Protection Systems," identifies the overpressure protection requirements needed to ensure that Appendix G limits are maintained. The LCO is revised to identify the proposed PORV lift point setting of 430 psia. Editorial changes are proposed for references to the MPT enable temperature to change the wording from "below 327°F" to "327°F or less." These changes occur on various affected pages within the TS. The staff has confirmed that the changes serve to clarify the reference and are acceptable.

TS 3.4.1.3, "Coolant Loops and Coolant Circulation Shutdown", concerns RCP controls. To accommodate the LTOP conditions for Modes 4 and 5, a footnote (***) appended to the Applicability of the LCO is revised to require that a RCP not be started when a RCS cold leg temperature is less than or equal to 327°F unless (1) the pressurizer indicated water level is less than 170 inches, (2) the secondary water temperature of each steam generator is less than or equal to 30°F above the RCS temperature, and (3) pressurizer pressure is less than or equal to 290 psia. These changes reflect the analysis assumptions for the limiting energy addition transient discussed above and are acceptable. The reference to a plant computer or equivalent precision instrument to measure pressure is being deleted since it applied only to the temporary approval granted for the period prior to entering Mode 2. In a related change, a footnote (**) is added to the Applicability of TS 3.4.1.2 to provide RCP start controls consistent with those in TS 3.4.1.3.

5.0 SUMMARY

The staff has concluded, based on the discussions included in Sections 3.0 and 4.0 above, that the proposed Technical Specifications supporting the new 12 EFPY heatup and cooldown curves and rates, the LTOP controls, and supporting technical specification Bases are acceptable.

6.0 ENVIRONMENTAL CONSIDERATION

This amendment involves a change to a requirement with respect to the installation or use of the facilities' components located within the restricted areas as defined in 10 CFR Part 20 and to a surveillance requirement. The staff has determined that this amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that my 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 and final determination that this amendment involves no significant hazards consideration and there has been no public comment on such finding. Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR Section 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 this amendment.

7.0 CONCLUSION

We have 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, and (2) such activities will be conducted in compliance with the commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Dated: September 18, 1990

PRINCIPAL CONTRIBUTORS:

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