

December 9, 2003

Mr. George Vanderheyden, Vice President  
Calvert Cliffs Nuclear Power Plant, Inc.  
Calvert Cliffs Nuclear Power Plant  
1650 Calvert Cliffs Parkway  
Lusby, MD 20657-4702

SUBJECT: CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2 -  
AMENDMENT RE: REVISIONS OF COOLDOWN RATES FOR REACTOR  
PRESSURE VESSEL PRESSURE-TEMPERATURE LIMITS (TAC NOS.  
MB9472 AND MB9473)

Dear Mr. Vanderheyden:

The Commission has issued the enclosed Amendment No. 261 to Renewed Facility Operating License No. DPR-53 and Amendment No. 238 to Renewed Facility Operating License No. DPR-69 for the Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2. These amendments consist of changes to the Technical Specifications (TSs) in response to your application transmitted by letter dated May 28, 2003, as supplemented November 25, 2003.

These amendments change the reactor pressure vessel pressure-temperature (P-T) limit cooldown curves in the Calvert Cliffs 1 and 2 TSs by incorporating a different range of temperatures for which a maximum cooldown rate of 100 °F/hr is acceptable.

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

Sincerely,

/RA Peter S. Tam for/

Guy S. Vissing, Senior Project Manager, Section 1  
Project Directorate 1  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket Nos. 50-317 and 50-318

Enclosures: 1. Amendment No. 261 to DPR-53  
2. Amendment No. 238 to DPR-69  
3. Safety Evaluation

cc w/encls: See next page

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cc w/encls: See next page

ADAMS Accession Numbers: Package: ML033140004; Amendment: ML032930365;  
TS(s): ML

OFFICE	PDI-1/PM	PDI-1/LA	DE/EMCB	IROB	PDI-1/SC	OGC
NAME	PTam for GVissing	SLittle	SCoffin*	KKavanagh for TBoyce	RLaufer	LZaccari
DATE	12/4/03	12/08/03	9/29/03	11/17/03	12/08/03	11/13/03

**OFFICIAL RECORD COPY**

\*Safety Evaluation provided; no substantive changes made

Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2

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DATED: December 9, 2003

AMENDMENT NO. 261 TO RENEWED FACILITY OPERATING LICENSE NO. DPR-53  
CALVERT CLIFFS UNIT 1

AMENDMENT NO. 238 TO RENEWED FACILITY OPERATING LICENSE NO. DPR-69  
CALVERT CLIFFS UNIT 2

DISTRIBUTION:

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PDI-1 R/F

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cc: Plant Service list

CALVERT CLIFFS NUCLEAR POWER PLANT, INC.

DOCKET NO. 50-317

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NO. 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 261  
Renewed License No. DPR-53

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Calvert Cliffs Nuclear Power Plant, Inc. (the licensee) dated May 28, 2003, as supplemented November 25, 2003, 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 Renewed 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. 261, are hereby incorporated into 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 120 days.

FOR THE NUCLEAR REGULATORY COMMISSION

*/RA/*

Richard J. Laufer, Chief, Section 1  
Project Directorate I  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Attachment:  
Changes to the Technical  
Specifications

Date of Issuance: December 9, 2003

CALVERT CLIFFS NUCLEAR POWER PLANT, INC.

DOCKET NO. 50-318

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NO. 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 238  
Renewed License No. DPR-69

1. The Nuclear Regulatory Commission (the Commission) has found that:
  - A. The application for amendment by Calvert Cliffs Nuclear Power Plant, Inc. (the licensee) dated May 28, 2003, as supplemented November 25, 2003, 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 Renewed Facility Operating License No. DPR-69 is hereby amended to read as follows:

2. Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 238, 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 120 days.

FOR THE NUCLEAR REGULATORY COMMISSION

**/RA/**

Richard J. Laufer, Chief, Section 1  
Project Directorate I  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Attachment:  
Changes to the Technical  
Specifications

Date of Issuance: December 9, 2003



ATTACHMENT TO LICENSE AMENDMENTS

AMENDMENT NO. 261 TO RENEWED FACILITY OPERATING LICENSE NO. DPR-53

AMENDMENT NO. 238 TO RENEWED FACILITY OPERATING LICENSE NO. DPR-69

DOCKET NOS. 50-317 AND 50-318

Replace the following pages of the Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove Pages

3.4.3-4  
3.4.3-6

Insert Pages

3.4.3-4  
3.4.3-6

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
RELATED TO AMENDMENT NO. 261 TO RENEWED  
FACILITY OPERATING LICENSE NO. DPR-53  
AND AMENDMENT NO. 238 TO RENEWED FACILITY OPERATING LICENSE NO. DPR-69  
CALVERT CLIFFS NUCLEAR POWER PLANT, INC.  
CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2  
DOCKET NOS. 50-317 AND 50-318

## 1.0 INTRODUCTION

By letter dated May 28, 2003, as supplemented November 25, 2003, Calvert Cliffs Nuclear Power Plant, Inc. (the licensee) submitted a request for changes to the Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2, Technical Specifications (TSs). The licensee requested to change the reactor pressure vessel (RPV) pressure-temperature (P-T) limit cooldown curves in the Calvert Cliffs 1 and 2 TSs. These changes incorporate a different range of temperatures for which a maximum cooldown rate of 100 °F/hr is acceptable. The proposed amendment would revise the cooldown curves (Figure 3.4.3-2 for each unit) to change the range of temperatures for which a cooldown rate of 100 °F/hr is acceptable. The November 25, 2003, supplemental letter provided clarifying information that did not change the initial proposed no significant hazards consideration determination.

## 2.0 REGULATORY EVALUATION

The Nuclear Regulatory Commission (NRC) has established requirements in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50 to protect the integrity of the reactor coolant pressure boundary in nuclear power plants. The NRC staff evaluates P-T limit curves based on the following NRC regulations and guidance: Appendix G to 10 CFR Part 50; Generic Letter (GL) 88-11; Regulatory Guide (RG) 1.99, Revision 2; GL 92-01, Revision 1; GL 92-01, Revision 1, Supplement 1; and Standard Review Plan (SRP) Section 5.3.2. Appendix G to 10 CFR Part 50 requires that P-T limit curves for the RPV be at least as conservative as those obtained by applying the methodology of Appendix G to Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code). GL 88-11 advised licensees that the staff would use RG 1.99, Revision 2 to review P-T limit curves. RG 1.99, Revision 2, contains methodologies for determining the increase in transition temperature and the decrease in upper-shelf energy (USE) resulting from neutron irradiation. GL 92-01, Revision 1 requested that licensees submit their RPV data for their plants to the staff for review. GL 92-01, Revision 1, Supplement 1 requested that licensees provide and assess data from other licensees that could affect their RPV integrity evaluations. These data are used

by the staff as the basis for the review of P-T limit curves. SRP Section 5.3.2 provides an acceptable method of determining the P-T limit curves for ferritic materials in the beltline of the RPV based on the linear elastic fracture mechanics (LEFM) methodology of Appendix G to Section XI of the ASME Code.

The basic parameter of the methodology of Appendix G to Section XI of the ASME Code is the stress intensity factor,  $K_I$ , which is a function of the stress state and flaw configuration. Appendix G to Section XI of the ASME Code requires a safety factor of 2.0 on stress intensities resulting from reactor pressure during normal and transient operating conditions, and a safety factor of 1.5 on stress intensities resulting from hydrostatic testing. Appendix G to Section XI of the ASME Code also requires a safety factor of 1.0 on stress intensities resulting from thermal loads for normal and transient operating conditions as well as for hydrostatic testing.

The methods of Appendix G postulate the existence of a sharp surface flaw in the RPV that is normal to the direction of the maximum stress (i.e., of axial orientation). This flaw is postulated to have a depth that is equal to 1/4 of the RPV beltline thickness and a length equal to six times its depth. The critical locations in the RPV beltline region for calculating heatup and cooldown P-T limit curves are the 1/4 thickness (1/4T) and 3/4 thickness (3/4T) locations, which correspond to the maximum depth of the postulated inside surface and outside surface defects, respectively.

The methodology found in Appendix G to Section XI of the ASME Code requires that licensees determine the adjusted reference temperature (ART or adjusted  $RT_{NDT}$ ) at the 1/4T and 3/4T locations. The ART is defined as the sum of the initial (unirradiated) reference temperature (initial  $RT_{NDT}$ ), the mean value of the adjustment in reference temperature caused by irradiation ( $\Delta RT_{NDT}$ ), and a margin term. Guidance on the determination of  $\Delta RT_{NDT}$  and the margin term is given in RG 1.99, Revision 2.  $\Delta RT_{NDT}$  is a product of a chemistry factor (CF) and a fluence factor. The CF is dependent upon the amount of copper and nickel in the material and may be determined from tables in RG 1.99, Revision 2, or from surveillance data. The fluence factor is dependent upon the neutron fluence at the maximum postulated flaw depth. The margin term is dependent upon whether the initial  $RT_{NDT}$  is a plant-specific or a generic value and whether the CF was determined using the tables in RG 1.99, Revision 2, or surveillance data. The margin term is used to account for uncertainties in the values of the initial  $RT_{NDT}$ , the copper and nickel contents, the fluence, and the calculational procedures.

### 3.0 TECHNICAL EVALUATION

#### 3.1 Licensee Evaluation

The proposed changes incorporate a different range of reactor coolant system (RCS) temperatures for which a cooldown rate of 100 °F/hr is acceptable. For Unit 1, the RCS temperature at which the specified maximum cooldown rate is reduced from 100 °F/hr to 40 °F/hr is being increased from 196 °F to 256 °F. For Unit 2, this corresponding RCS temperature is being increased from 136 °F to 146 °F. The proposed license amendment seeks to maintain the current P-T limits. The existing P-T limits are based on the use of the lower bound static initiation fracture toughness ( $K_{IC}$ ) curve, in lieu of the lower bound crack arrest fracture toughness ( $K_{IA}$ ) curve, as permitted by the application of ASME Code Case N-640, in conjunction with the original requirements of ASME Code, Section XI, Appendix G.

All other aspects of the ASME Code, Section XI, Appendix G process for determining P-T limit curves, including the material properties of the limiting beltline material, remain unchanged in the licensee's evaluation.

The licensing basis for the P-T limit curves at Calvert Cliffs 1 and 2, as given in the TSs, includes Figures 3.4.3-1 and 3.4.3-2. Figure 3.4.3-2 provides P-T limits for normal cooldown, inservice leak and hydrostatic testing, as well as data for the maximum rate of change of reactor coolant temperature during cooldown. The proposed TS changes replace Figures 3.4.3-2 for Unit 1 and Unit 2.

### 3.2 NRC Staff Evaluation

As discussed previously, the proposed changes modify the range of acceptable temperatures for a specified maximum cooldown rate of 100 °F/hr on P-T limit curves for cooldown events. The licensee is proposing to increase the temperature at which the specified maximum cooldown rate is reduced from 100 °F/hr to 40 °F/hr. For Unit 1 the RCS temperature at which the specified maximum cooldown rate is reduced from 100 °F/hr to 40 °F/hr is being increased from 196 °F to 256 °F. For Unit 2 this corresponding RCS temperature is being increased from 136 °F to 146 °F. These are the only changes that the licensee is proposing for TS Figures 3.4.3-2 for Unit 1 and Unit 2. The actual P-T limits remain unaffected by this amendment.

The existing P-T limit curves are based on the use of the lower bound static initiation fracture toughness ( $K_{IC}$ ) curve, in lieu of the lower bound crack arrest fracture toughness ( $K_{IA}$ ) curve, as permitted by the application of ASME Code Case N-640, in conjunction with the original requirements of ASME Section XI, Appendix G. The NRC staff verified that the licensee was authorized to use  $K_{IC}$  as the basis fracture toughness parameter in the computation of P-T limit curves for the Calvert Cliffs 1 and 2 RPVs. The exemption authorizing the use of  $K_{IC}$  as the basis fracture toughness parameter in the computation of P-T limit curves for the Calvert Cliffs 1 and 2 RPVs is provided in Reference 1. The license amendment incorporating revised TS P-T limit curves calculated using  $K_{IC}$  as the basis fracture toughness parameter is provided in Reference 2.

In order to develop P-T limits for cooldown transients, both the isothermal (0 °F/hr) P-T limit and the P-T limit representing the maximum cooldown rate must be calculated at each RCS temperature. The isothermal P-T limit represents a uniform temperature profile across the RPV beltline wall. It assumes that the cooldown process has been suspended at some RCS temperature, and the temperature profile across the RPV wall has been permitted to come to thermal equilibrium with the RCS. For isothermal conditions, thermal gradients and thermal stresses are equal to zero. However, on cooldown transients the isothermal limits also result in the lowest reference fracture toughness at the 1/4T location. This is due to the fact that during a cooldown transient, the RCS temperature is always lower than the metal temperature at the 1/4T location. When the cooldown process is suspended, and isothermal conditions are achieved, the metal temperature at the 1/4T location has decreased to where it is equal to the RCS temperature. This results in the lowest possible 1/4T fracture toughness for a given RCS temperature. Therefore, on cooldown transients there is a possibility that the isothermal P-T limit may be the most restrictive. The final composite P-T limit cooldown curve must always represent the most restrictive conditions for each point on the curve. This is achieved by

comparing the isothermal P-T limit with the P-T limit representing the maximum cooldown rate for each point in P-T space and utilizing the P-T limit that is the most restrictive.

Based on a review of previous license amendments issued for Calvert Cliffs 1 and 2 on March 15 and November 1, 1994 (References 3 and 4), the NRC staff determined that the licensee had developed composite P-T limits for cooldown events by evaluating P-T limits for the maximum cooldown rate at the 1/4T and 3/4T locations. The licensee also evaluated the corresponding P-T limits for the isothermal (0 °F/hr) condition. These three sets of P-T limits were compared to determine the most limiting conditions over the entire temperature interval. This resulted in a composite P-T limit curve for the RPV beltline that was representative of the most restrictive conditions for the cooldown event. This methodology ensures that, for a specified maximum cooldown rate, the licensee can safely restrict the actual cooldown rates to values less than or equal to the specified maximum cooldown rate over the specified temperature interval.

The licensee has developed a composite P-T limit curve for the cooldown event by accounting for the most limiting conditions. The P-T limits were calculated by taking into consideration both the maximum cooldown rate and the isothermal (0 °F/hr) condition over all temperature intervals. The P-T limits are therefore acceptable for all cooldown rates less than or equal to the maximum cooldown rates specified in the TS P-T limit curves. The licensee has proposed to restrict the maximum allowable cooldown rate of 100 °F/hr to higher RCS temperatures. This results in the cooldown rate being restricted to a lower value over the affected RCS temperature intervals. Therefore, the proposed change to the acceptable temperature range for the specified maximum cooldown rate of 100 °F/hr is more conservative than the previously specified temperature range for the 100 °F/hr specified maximum cooldown rate.

Based on this assessment, the NRC staff concludes that the proposed changes to the RCS temperature ranges for the 100 °F/hr maximum cooldown rate specified on the P-T limit cooldown curves satisfy the requirements in Appendix G to 10 CFR Part 50 and Appendix G to Section XI of the ASME Code, as modified by ASME Code Case N-640. Therefore, the proposed revisions to the P-T limit cooldown curves are acceptable for incorporation into the Calvert Cliffs 1 and 2 TSs.

#### 4.0 REFERENCES

1. Letter from Ms. D. M. Skay, USNRC to Mr. C. H. Cruse, Vice President, Calvert Cliffs Nuclear Power Plant, Constellation Nuclear, "Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 - Exemption from the Requirements of 10 CFR Part 50, Section 50.60(a) and Appendix G (TAC Nos. MB0001 and MB0002)," dated February 26, 2001.
2. Letter from Ms. D. M. Skay, USNRC to Mr. C. H. Cruse, Vice President, Calvert Cliffs Nuclear Power Plant, Constellation Nuclear, "Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 - Amendment Re: Pressure-Temperature Curves (TAC Nos. MA9999 and MB0000)," dated March 15, 2001.
3. Letter from Mr. D. G. McDonald, USNRC to Mr. R. E. Denton, Vice President, Baltimore Gas and Electric Co., "Issuance of Amendment for Calvert Cliffs Nuclear Power Plant, Unit No. 1 (TAC No. M87690)," dated March 15, 1994.

4. Letter from Mr. D. G. McDonald, USNRC to Mr. R. E. Denton, Vice President, Baltimore Gas and Electric Co., "Issuance of Amendment for Calvert Cliffs Nuclear Power Plant, Unit No. 2 (TAC No. M89588)," dated November 1, 1994.

#### 5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Maryland State official was notified of the proposed issuance of the amendments. The State official had no comments.

#### 6.0 ENVIRONMENTAL CONSIDERATION

The amendments change a requirement with respect to use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (68 FR 40710). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

#### 7.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: C. Sydnor

Date: December 9, 2003