



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 162 TO FACILITY OPERATING LICENSE NO. DPR-69
BALTIMORE GAS AND ELECTRIC COMPANY
CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NO. 2
DOCKET NO. 50-318

1.0 INTRODUCTION

By letter dated November 1, 1993, as supplemented February 1, 1994, the Baltimore Gas and Electric Company (the licensee) submitted a request for changes to the Calvert Cliffs Nuclear Power Plant, Unit No. 2 Technical Specifications (TSs). The requested changes would revise the heatup and cooldown curves for Unit 2, to allow operation beyond 12 effective full-power years (EFPY). Operation within the appropriate heatup and cooldown curves ensure that the 10 CFR Part 50, Appendix C, Pressure-Temperature (P-T) limits for the reactor pressure vessel will not be violated. The February 1, 1994, letter provided clarifying information that did not change the initial proposed no significant hazards consideration determination.

The current 12 EFPY heatup and cooldown curves for Unit 2 will expire, at the earliest, in mid-June 1994. These proposed changes will extend the applicability of these curves to mid-1996. During the 1995 refueling outage, a variable-setpoint low temperature overpressure protection (VLTOP) system is scheduled to be installed at Unit 2 to increase the allowable operating pressure band in the Minimum Pressure and Temperature region. A license amendment request will be submitted at a later date proposing new heatup and cooldown curves and Low Temperature Overpressure Protection (LTOP) controls for Unit 2 to support the scheduled modifications to the LTOP system. The proposed change to extend the current heatup and cooldown curves will allow the use of these curves until the VLTOP system is implemented.

Changes to the TS P-T limits are being proposed as a result of the licensee's revision of copper and nickel contents in the limiting reactor vessel material, axial weld 2-203-A, B and C. The changes also included the use of neutron fluences as the applicable period for the limits rather than EFPY. The applicable period of the proposed P-T limits will be changed from 12 EFPY to neutron fluences up to $1.92E19$ neutron/cm², which is about 13.8 EFPY.

On October 22, 1990, the licensee proposed the P-T limit curves for 12 EFPY, which were developed based on the copper and nickel contents of the limiting material, weld 2-203. At that time, the licensee believed that weld 2-203 had 0.12% copper and 1.01% nickel. On December 18, 1990, the staff approved the amendment request.

On February 16, 1993, the licensee revised the chemistry of weld 2-203 to 0.16% copper and 0.10% nickel as a part of response to the pressurized thermal shock (PTS) rule in 10 CFR 50.61. On May 24, 1993, the staff approved the licensee's revised chemistry for weld 2-203 and the response to PTS rule. With a lower nickel content, weld 2-203 was no longer limiting. Subsequently, the licensee identified a limiting reactor vessel material and submitted the revised P-T limits for staff approval.

To evaluate the P-T limits, the staff uses the following NRC regulations and guidance: Appendices G and H of 10 CFR Part 50; Generic Letter (GL) 88-11; Regulatory Guide (RG) 1.99, Revision 2; and Standard Review Plan (SRP) Section 5.3.2.

Appendix G to 10 CFR Part 50 requires that "... when the core is not critical pressure-temperature limits for the reactor vessel must be at least as conservative as those obtained by following the methods of analysis and the required margins of safety of Appendix G of the ASME [American Society of Mechanical Engineers] Code..." Appendix G also imposes requirements on the minimum temperature for criticality, the closure head flange, and hydrostatic pressure tests or leak tests.

Appendix H of 10 CFR Part 50 requires licensees to establish a surveillance program to monitor embrittlement of reactor vessel materials. The program includes capsules that contain test specimens made from plate, weld, and heat-affected-zone (HAZ) materials of the reactor beltline. Appendix H refers to the American Society of Testing and Materials Standards which, in turn, require that the capsules be installed in the vessel before startup and be removed from the reactor vessel periodically for testing. The test results may be used in calculating P-T limits.

GL 88-11 provides that licensees may use the methods in RG 1.99, Revision 2, to predict the embrittlement effect of neutron irradiation on reactor vessel materials. The embrittlement effect is defined in terms of adjusted reference temperatures (ARTs), which is the sum of unirradiated reference temperature, the increase in reference temperature resulting from neutron irradiation, and a margin to account for uncertainties in the unirradiated reference temperature, copper and nickel contents, fluence, and the calculational procedures.

SRP 5.4.2 describes a calculation of the P-T limit curves based on the principles of linear elastic fracture mechanics. SRP 5.3.2 calculation follows the methodology specified in Appendix G to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section III.

2.0 EVALUATION

The licensee determined that base plate, D-8906-1, was the limiting material with 0.15% copper and 0.56% nickel. For the amendment request, the licensee did not change the current P-T curves because the ARTs used in the current P-T curves were conservative to bound the ARTs derived from plate D-8906-1. The

ARTs in the current P-T limits were 171 °F and 125 °F at the 1/4T and 3/4T locations, respectively (T = the thickness of the reactor vessel at the beltline region).

The staff verified that plate D-8906-1 is limiting and calculated the ARTs of 156 °F and 125 °F at 1/4T and 3/4T locations, respectively, using Regulatory Guide 1.99, Position C.1. The ARTs were calculated based on the above plate chemistry and a neutron fluence of $1.92E19$ n/cm². Because the ARTs in the proposed P-T limits are either higher than (171 °F versus 156 °F) or the same as (125 °F) the ARTs that the staff calculated, the staff finds that the ARTs in the proposed P-T limits are acceptable.

Based on SRP 5.3.2, the staff verified that the proposed P-T limits for heatup, cooldown, criticality, and inservice hydrostatic test meet the requirements in Paragraphs IV.A.2 & IV.A.3 of Appendix G.

In addition to beltline materials, Appendix G of 10 CFR Part 50, also imposes a minimum temperature at the closure head flange based on the reference temperature for the flange material. Section IV.A.2 of Appendix G states that when the pressure exceeds 20 percent of the preservice system hydrostatic test pressure, the temperature of the closure flange regions highly stressed by the bolt preload must exceed the reference temperature of the material in those regions by at least 120 °F for normal operation and by 90 °F for hydrostatic pressure tests and leak tests. Based on the flange reference temperature of 10 °F provided by the licensee, the staff has determined that the proposed P-T limits have satisfied the requirement for the closure flange region during normal operation, hydrostatic pressure test and leak test.

The licensee has removed surveillance capsule 263 from Calvert Cliffs Unit 2 and has submitted the surveillance report. The staff has determined that the surveillance report has satisfied Appendix H to 10 CFR Part 50.

The staff has performed an independent analysis to verify the licensee's proposed P-T limits. The staff has determined that the proposed P-T limits for heatup, cooldown, inservice hydrostatic test, and criticality are valid for peak neutron fluences less than or equal to $1.921E19$ n/cm² because the limits conform to the requirements of Appendix G of 10 CFR Part 50 and GL 88-11.

The peak fluence on the inside surface of the limiting component (plate D-8906-1) has been changed from 1.69×10^{19} n/cm² to 1.92×10^{19} n/cm². This change is based on lower copper and nickel contents for plate D-8906-1. The lower copper and nickel values have been reviewed and accepted by the staff as noted above, therefore, the new fluence value is acceptable on the same basis the old fluence value of 1.69×10^{19} n/cm² was accepted.

The specific TS changes proposed are: (1) TS Figures 3.4.9-1 and 3.4.9-2 are modified to reflect the current fluence predictions which will extend the applicability of the existing curves to approximately 13.8 EFPY. The expected fluence number will replace the projected EFPY number, (2) TS 3/4.4.9.3 is modified to include an additional overpressure requirement which will ensure

that when the operable high-pressure safety injection pump is not in use, its handswitch is in the pull-to-lock position. This prevents the pump from automatically starting. This is for clarification only in that it is currently required as specified in a footnote to TS 3/4.5.3 and Table 3.3-3, (3) TS 3/4.4.9.3.3 is also modified to reflect this change, and (4) TS Bases 3/4.4.9 is revised to reflect the requested changes.

We have determined, based on the details provided above, that the proposed TS changes are acceptable in that the limits proposed satisfy the requirements of 10 CFR Part 50, Appendix G.

3.0 STATE CONSULTATION

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

4.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding (58 FR 62150). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

5.0 CONCLUSION

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

Principal Contributors:

J. Tsao
L. Lois

Date: March 1, 1994

March 1, 1994

Mr. Robert E. Denton
Vice President - Nuclear Energy
Baltimore Gas and Electric Company
Calvert Cliffs Nuclear Power Plant
1650 Calvert Cliffs Parkway
Lusby, Maryland 20657-4702

Dear Mr. Denton:

SUBJECT: ISSUANCE OF AMENDMENT FOR CALVERT CLIFFS NUCLEAR POWER PLANT,
UNIT NO. 2 (TAC NO. M88143)

The Commission has issued the enclosed Amendment No. 162 to Facility Operating License No. DPR-69 for the Calvert Cliffs Nuclear Power Plant, Unit No. 2. This amendment consists of changes to the Technical Specifications in response to your application transmitted by letter dated November 1, 1993, as supplemented on February 1, 1994.

The amendment revises the heatup and cooldown curves which will allow operation beyond the current 12 effective full power years (EFPY) to approximately 13.8 EFPY. The increase in this EFPY will allow Unit 2 to operate until its next refueling outage (RFO-10) in accordance with the requirements of 10 CFR Part 50, Appendix G.

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,
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. 162 to DPR-69
2. Safety Evaluation

cc w/enclosures:
See next page

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CVogon <i>[Signature]</i>	DMcDonald:smm	MLOBLG	RACapra <i>[Signature]</i>		
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corrections*