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Constellation
Nuclear

Calvert Cliffs
Nuclear Power Plant

A Member of the
Constellation Energy Group

September 14, 2000

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
License Amendment Request: Add ABB-NV and ABB-TV Critical Heat Flux Correlations to the Technical Specifications

REFERENCE: (a) Letter from Mr. S. A. Richards (NRC), to Mr. I. C. Rickard (ABB Combustion Engineering), dated March 16, 2000, Acceptance for Referencing of CENPD-387-P, Revision-00-P, "ABB Critical Heat Flux Correlations for PWR Fuel" (TAC No. MA6109)

Pursuant to 10 CFR 50.90, the Calvert Cliffs Nuclear Power Plant, Inc. hereby requests an amendment to Renewed Operating License Nos. DPR-53 and DPR-69 to add two analytical methods to the list of approved core operating limits analytical methods in the Technical Specifications for Calvert Cliffs Unit Nos. 1 and 2. In Reference (a), Nuclear Regulatory Commission approved the topical CENPD-387-P, "ABB Critical Heat Flux Correlations for PWR Fuel" for referencing in licensing applications for Asea Brown Boveri, Inc.-Combustion Engineering, Inc. (ABB-CE) plants. Attachment (1) contains a complete discussion of this change.

REQUESTED CHANGES

The proposed changes to Technical Specification 5.6.5.b are shown in Attachment (3). The final Technical Specification pages will be renumbered to accommodate the insertion of this change. The same change will be made in the Core Operating Limits Report using the 10 CFR 50.59 process.

ASSESSMENT AND REVIEW

We have considered the possibility of significant hazards associated with this change and have determined that there are none (see Attachment 2 for a complete discussion). We have also determined that operation with the proposed amendment would not result in any significant change in the types, or significant increases in the amounts, of any effluents that may be released offsite, nor would it result in any significant increase in individual or cumulative occupational radiation exposure. Therefore, the

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proposed amendment is eligible for categorical exclusion as set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment is needed in connection with the approval of the proposed amendment. The Plant Operations and Safety Review Committee and Offsite Safety Review Committee have reviewed this proposed change and concur that operation with the proposed changes will not result in an undue risk to the health and safety of the public.

SCHEDULE

This change is requested to be approved and issued by February 1, 2001. Should this request not be granted, we would need to redo the reload calculation to support the next Unit 2 refueling outage, which is expected to begin in March 2001. We believe this amendment presents some operational advantages, does not adversely impact plant safety, and should be approved.

Should you have questions regarding this matter, we would be pleased to discuss them with you.

Very truly yours,

STATE OF MARYLAND :

: **TO WIT:**

COUNTY OF CALVERT :

I, Charles H. Cruse, being duly sworn, state that I am Vice President, Nuclear Energy, Calvert Cliffs Nuclear Power Plant, Inc. (CCNPP), and that I am duly authorized to execute and file this License Amendment Request on behalf of CCNPP. To the best of my knowledge and belief, the statements contained in this document are true and correct. To the extent that these statements are not based on my personal knowledge, they are based upon information provided by other CCNPP employees and/or consultants. Such information has been reviewed in accordance with company practice and I believe it to be reliable.

Subscribed and sworn before me, a Notary Public in and for the State of Maryland and County of CALVERT, this 14th day of SEPTEMBER, 2000.

WITNESS my Hand and Notarial Seal:

Lynn M. Taylor
Notary Public

My Commission Expires: 2/1/02
Date

CHC/DJM/bjd

Attachments: (1) Background and Analysis
(2) Determination of Significant Hazards
(3) Technical Specifications Marked-Up Pages

cc: R. S. Fleishman, Esquire
J. E. Silberg, Esquire
Director, Project Directorate I-1, NRC
A. W. Dromerick, NRC
H. J. Miller, NRC
Resident Inspector, NRC
R. I. McLean, DNR

ATTACHMENT (1)

BACKGROUND AND ANALYSIS

Calvert Cliffs Nuclear Power Plant, Inc.
September 14, 2000

ATTACHMENT (1)

BACKGROUND AND ANALYSIS

Calvert Cliffs Nuclear Power Plant (CCNPP) currently uses fuel assemblies with a non-mixing vane grid design. To provide additional operating margin, we proposed implementing different critical heat flux (CHF) correlations for our current non-mixing fuel design and for the new Turbo mixing vane fuel design. To improve fuel performance, we are scheduled to insert fuel assemblies designed with a mixing vane grid (Turbo fuel) during the next Unit 1 refueling outage. As Turbo fuel is introduced to the reactors, transition cores will exist in which Turbo mixing vane grid fuel assemblies are co-residents with non-mixing vane grid fuel assemblies.

We currently use the CE-1 correlation for 14x14 non-mixing vane fuel provided in CENPD-162-P-A and CENPD-207-P-A. A new correlation is needed for the non-mixing vane grid fuel to incorporate the following improvements in the correlation for non-mixing vane fuel:

- Special geometry effects for the grid, heated length, and guide tube to improve the fit of the CHF data.
- Optimization of the constants of the Tong F_C shape factor for the non-uniform CHF data.
- Use of primary CHF indication.

Also, a new correlation was needed for the mixing vane grid fuel to fit the Combustion Engineering Nuclear Power[1] (CENP) 6x6 CHF test data that supports the 14x14 Turbo spacer grid for Turbo fuel.

The new correlation form that was developed fits both the 14x14 non-mixing vane and Turbo mixing vane CHF databases. The two correlations, ABB-NV (non-mixing vane) and ABB-TV (Turbo vane), utilize the same form but use different constants for a portion of the correlation. The new departure from nucleate boiling (DNB) correlation form also includes the optimized Tong F_C shape factor constants. The new ABB-NV and ABB-TV correlations provide a departure from nucleate boiling ratio (DNBR) limit of 1.13. As stated in CENPD-387-P-A, Revision 000, the ABB-NV correlation will not supersede the CE-1 correlation.

Topical Report CENPD-387-P-A, Revision 000, "ABB Critical Heat Flux Correlation for PWR Fuel" describes the critical heat flux correlations for ABB 14x14 non-mixing (ABB-NV) and Turbo mixing vane (ABB-TV) fuel designs and the impact of using either correlation on the reload analysis and the approach for using ABB-NV with ABB-TV in transition cores. The Nuclear Regulatory Commission (NRC) staff reviewed the detailed application of the ABB-NV and ABB-TV correlations on existing topical reports and concluded that the methods described are acceptable, as long as they are followed explicitly (Reference 1). Any change from what is described in Section 7.1 of CENPD-387-P-A must have NRC approval. Topical Report CENPD-387-P-A discusses the HID-1 Grid Spacing DNB Penalty. This penalty is not applicable to CCNPP due to the 14x14 fuel design grid spacing being equal to that used in the DNB test section. Therefore, the methods described in Section 7.1 of CENPD-387-P-A are applicable to CCNPP.

Although not explicitly mentioned in CENPD-387-P-A, we use the convolution technique described in the Loss of Flow Report to determine the fuel failure at or near the time of trip for the steam line break event (Reference 2). As discussed in CENPD-387-P-A, the use of ABB-NV and/or ABB-TV correlation will cause the fuel damage probability distribution to change. For CCNPP, the impact on the steam line

1 CE Nuclear Power LLC (CENP), formerly ABB CE, became a wholly-owned subsidiary of Westinghouse Electric Company in April 2000.

break analysis is the same as that discussed for the Loss of Flow Report. The NRC approved the use of the convolution technique in this manner for CCNPP in Reference 3.

Additionally, the NRC staff concluded that Topical Report CENPD-387-P-A is acceptable for licensing applications, subject to the following conclusions and conditions:

1. The ABB-NV and ABB-TV correlations indicate a minimum DNBR limit of 1.13 will provide a 95% probability with 95% confidence of not experiencing CHF on a rod showing the limiting value.
2. The ABB-NV and ABB-TV correlations must be used in conjunction with the TORC code since the correlations were developed on the basis of TORC and the associated TORC input specifications. The correlations may also be used in the CETOP-D code in support of reload design calculations.
3. The ABB-NV and ABB-TV correlations must also be used with the optimized Tong F_C shape factor to correct for non-uniform axial power shapes.
4. Ranges of applicability for the ABB-NV and ABB-TV correlations:

Parameter	ABB-NV Range	ABB-TV Range
Pressure (psia)	1750 to 2415	1500 to 2415
Local Mass Velocity (Mlbm/hr-ft^2)	0.80 to 3.16	0.90 to 3.40
Local Quality	-0.14 to 0.22	-0.10 to 0.225
Heated Length, (inlet to CHF Location, in)	48 to 150	48 to 136.7
Grid Spacing (in)	8 to 18.86	8 to 18.86
Heated hydraulic Diameter ratio, D_{hm}/D_h	0.679 to 1.08	0.679 to 1.00

5. The ABB-NV and ABB-TV correlation will be implemented in the reload analysis in the exact manner described in Section 7.1 of Topical Report CENPD-387-P-A.
6. Technology Transfer will be accomplished only through the process described to the NRC, which includes CENP performing an independent benchmarking calculation for comparison to the licensee generated results to verify that the licensee properly applies the new CHF correlations for the first application.

We agree with the conclusions and conditions described above.

Topical Report CENPD-387-P-A states that no changes are to be made to the CHF bow effect model unless rod bow data for the Turbo fuel becomes more severe than that for non-mixing fuel. The rod bow penalty for the Turbo fuel will be the same as non-mixing fuel. We plan to perform measurements to confirm the rod bow penalty on a lead test assembly that contains the Turbo mixing grids.

Topical Report CENPD-387-P-A, Section 7.2.1, describes the approach to use for cores containing non-mixing grid fuel assemblies that have different grid loss coefficients. The conditions for fuel assembly and grid compatibility that must be met in order for the ABB-NV CHF correlation to be valid are presented in CENPD-199-P, Revision 1-P-A, Supplement 2-P-A, Appendix A. For CCNPP, the use of the ABB-NV correlation does not involve a change in the grid type. If we change to a different grid type, such as that from a different fuel vendor, then a separate submittal would be made at that time.

Topical Report CENPD-387-P-A, Section 7.2.2, describes the application of the new CHF correlations during the transition to Turbo fuel cores. Appendix A to CENPD-199-P, Revision 1-P-A, Supplement 2-P-A describes the mixed core hydraulic methodology. Section A.4 concluded that TORC accurately predicts the flow conditions in adjacent fuel bundles that contain grids with significantly different designs and loss coefficients. Topical Report CENPD-199-P, Revision 1-P-A, Supplement 2-P-A, Appendix A is being added to the methodologies listed in our Technical Specifications. The application of the ABB-NV and ABB-TV CHF correlations and codes, setpoints and uncertainty analysis will be the same for transition cores.

Included in the analytical methods listed in Technical Specification 5.6.5.b are the methodologies employed in the Emergency Core Cooling Systems (ECCS) performance analysis. No changes to these analytical methods are required for either a transition core or a full core of Turbo fuel assemblies. Combustion Engineering Nuclear Power has reviewed the evaluation model (analytical methods) used in our ECCS performance analysis and has determined that it is capable of conservatively representing the Turbo fuel design in a transition core that contains both Turbo and non-Turbo fuel assemblies and in a full core of Turbo fuel assemblies.

For a full core of Turbo fuel, the evaluation model is applied exactly as it is applied to a full core of non-Turbo fuel. The thermal hydraulic characteristics of Turbo fuel are similar to those previously used by CENP in the application of the evaluation model. As accepted by the NRC, the evaluation model does not include a grid heat transfer model and, therefore, does not benefit from the improved heat transfer characteristics of the ABB-TV grid.

For the transition core, the non-uniform thermal hydraulic behavior is modeled using features of the evaluation model reviewed and accepted by the NRC. In the evaluation model, the core thermal hydraulic response during the blowdown phase of the transient is calculated using multiple radial and axial regions in the core. Consequently, flow redistribution resulting from differences in flow resistance between the Turbo and non-Turbo fuel assemblies are accommodated through computer code inputs that define the hydraulic resistances of the Turbo and non-Turbo fuel assemblies. Similarly, the core thermal hydraulic response during the reflood phase of the transient can be conservatively calculated using a bounding core-wide axial flow resistance.

We will report the effect of the Turbo fuel on the limiting ECCS analysis in accordance with 10 CFR 50.46(a)(3)(ii) for both the transition core and full core implementation of Turbo fuel. The effect of the Turbo fuel on the application of the evaluation model to Calvert Cliffs is expected to not be significant as defined in 10 CFR 50.46(a)(3)(i). Consequently, the effect will be reported to the NRC in the appropriate annual report.

Therefore, we propose to revise Technical Specification 5.6.5.b to include CENPD-387-P-A and CENPD-199-P, Revision 1-P-A, Supplement 2-P-A, Appendix A in the list the analytical methods we are allowed to use to determine the core operating limits. The use of the ABB-NV or ABB-TV correlation requires the addition of CENPD-387-P-A to the list of approved Topical Reports. The Topical Reports describing the CE-1 correlation (CENPD-162-P-A and CENPD-207-P-A) will not be removed, allowing for the continued use of the CE-1 correlation. The mixed core hydraulic methodology described in CENPD-199-P, Revision 1-P-A, Supplement 2-P-A, Appendix A is being added to Technical Specification 5.6.5.b because it demonstrates that TORC accurately predicts the flow conditions in adjacent fuel assemblies that contain grids with significantly different designs and grid loss coefficients.

References:

(1) Letter from Mr. S. A. Richards (NRC), to Mr. I. C. Rickard (ABB-CE), dated March 16, 2000, Acceptance for Referencing of CENPD-387-P, Revision-00-P, "ABB Critical Heat Flux Correlations for PWR Fuel" (TAC No. MA6109)

(2) Letter from Mr. R. E. Denton (BGE) to NRC Document Control Desk, dated November 1, 1994, Request for Approval to Use Convolution Technique in Main Steam Line Break Analysis

(3) Letter from Mr. D. G. McDonald, Jr. (NRC) to Mr. R. E. Denton (BGE), dated May 11, 1995, Approval to Use Convolution Technique in Main Steam Line Break Analysis – Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 (TAC Nos. M90897 and M90898)

ATTACHMENT (2)

DETERMINATION OF SIGNIFICANT HAZARDS

Calvert Cliffs Nuclear Power Plant, Inc.
September 14, 2000

ATTACHMENT (2)

DETERMINATION OF SIGNIFICANT HAZARDS

Calvert Cliffs Nuclear Power Plant, Inc. (CCNPP) is proposing a change to the Technical Specifications for Calvert Cliffs Unit Nos. 1 and 2 to allow the use of a new critical heat flux (CHF) correlation. The proposed change to Technical Specification 5.6.5.b adds CENPD-387-P-A and CENPD-199-P-A, Supplement 2-P-A, Appendix A to the list of analytical methods used to determine the core operating limits.

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 operation of the facility in accordance with the proposed amendments:

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

   The proposed change allows the use of the ABB-NV and ABB-TV CHF correlations in the thermal hydraulic analysis for Calvert Cliffs Nuclear Power Plant. The ABB-NV correlation is used for a non-mixing vane fuel assembly and the ABB-TV correlations are used for a Turbo mixing vane fuel assembly. The CHF correlations determine the departure from nucleate boiling ratio (DNBR). The specified acceptable fuel design limit for DNBR will change for ABB-NV and ABB-TV. The use of the ABB-NV and/or ABB-TV correlations with the appropriate DNBR limit provides additional operating margin for those analyses that presently use the CE-1 correlation.

   The use of a different CHF correlation will not increase the probability of an accident because the plant systems will not be operated outside of design limits, the plant equipment will not be operated in a different manner, and system interfaces will not change.

   As Turbo fuel is introduced to reactor, transition cores will exist in which Turbo mixing vane grid fuel assemblies are co-residents with non-mixing vane grid fuel assemblies. The grid hydraulic loss coefficient in the Turbo grids is greater than the grid hydraulic loss coefficient for the non-mixing grids. The flow diversion that will result does not increase the probability of an accident previously evaluated because assembly flow has no impact on accident initiators, and because plant systems will not be operated outside of design limits, plant equipment will not be operated in a different manner, and system interfaces will not change.

   The change in the CHF correlation was the subject of Topical Report CENPD-387-P-A, which was reviewed and approved by the Nuclear Regulatory Commission. The use of a different CHF correlation will not increase the consequences of an accident because Limiting Conditions of Operation (LCOs) will continue to restrict operation to within the regions that provide acceptable results, and Reactor Protection System (RPS) trip setpoints will restrict plant transients so that the consequences of accidents will be acceptable.

   The transition cores that will exist as Turbo fuel is introduced to the reactor will not increase the consequences of an accident. The TORC code accurately predicts the flow conditions in adjacent fuel bundles that contain grids with different designs and loss coefficients. The flow diversion will be compensated for by DNBR margin gains. Operation within the LCOs and RPS setpoints will continue to restrict plant transients so that the consequences of accidents will be acceptable.

   Therefore, the proposed Technical Specification changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.

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

   The proposed change does not add any new equipment, modify any interfaces with any existing equipment, alter the equipment's function or change the method of operating the equipment. The proposed change does not alter plant conditions in a manner that could affect other plant components. The proposed change does not cause any existing equipment to become an accident initiator. The Turbo grid design does not introduce features that could initiate an accident.

   Therefore, the proposed changes do not create the possibility of a new or different kind of accident from any accident previously evaluated.

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

   Safety Limits ensure that specified acceptable fuel design limits are not exceeded during steady state operation, normal operational transients, and anticipated operational occurrences. One of the safety limits that accomplishes this is the DNBR limit. The CHF correlations that have been approved for ABB-NV and ABB-TV result in a DNBR limit that provides a 95% probability, at a 95% confidence, that the hot fuel rod in the core will not experience departure from nucleate boiling. The RPS in combination with the LCOs, will continue to prevent any anticipated combination of transient conditions for reactor coolant system temperature, pressure and thermal power level that would result in a violation of the Safety Limits.

   Therefore, the margin of safety is not significantly reduced by this proposed change.

ATTACHMENT (3)

TECHNICAL SPECIFICATIONS

MARKED-UP PAGES

5.0-38

5.6 Reporting Requirements

41. The power distribution monitoring system referenced in various specifications and the BASES, is described in the following documents:

    i. CENPD-153-P, Latest Approved Revision, "Evaluation of Uncertainty in the Nuclear Power Peaking Measured by the Self-Powered, Fixed Incore Detector System"

    ii. CEN-119(B)-P, "BASSS, Use of the Incore Detector System to Monitor the DNB-LCO on Calvert Cliffs Unit 1 and Unit 2," November 1979

    iii. Letter from Mr. G. C. Creel (BG&E) to NRC Document Control Desk, dated February 7, 1989, "Calvert Cliffs Nuclear Power Plant Unit No. 2; Docket 50-318, Request for Amendment, Unit 2 Ninth Cycle License Application"

    iv. Letter from Mr. S. A. McNeil, Jr. (NRC) to Mr. G. C. Creel (BG&E), dated January 10, 1990, "Safety Evaluation Report Approving Unit 2 Cycle 9 License Application"

42. Letter from Mr. D. G. McDonald, Jr. (NRC) to Mr. R. E. Denton (BGE), dated May 11, 1995, "Approval to Use Convolution Technique in Main Steam Line Break Analysis - Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 (TAC Nos. M90897 and M90898)

INSERT A

c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, ECCS limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.

d. The COLR, including any mid cycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

INSERT A

43. CENPD-387-P-A, Latest Approved Revision, "ABB Critical Heat Flux Correlations for PWR Fuel"

44. CENPD-199-P, Supplement 2-P-A, Appendix A, Latest Approved Revision, "CE Setpoint Methodology," June 1998