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February 8, 1991

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit No. 1; Docket No. 50-317
Request for Emergency License Amendment; CEA Operability

Gentlemen:

The Baltimore Gas and Electric (BG&E) Company hereby requests an Emergency Amendment to its Operating License No. DPR-53 for Calvert Cliffs Unit No. 1, to allow continued operation of Unit 1 for the remainder of the current fuel cycle with the center Control Element Assembly (CEA) excluded from operability and alignment requirements. Accordingly, we request a change to the series of Technical Specifications which describe CEA operability and alignment requirements, pursuant to 10 CFR 50.90. The proposed amendment is only needed for the remainder of Unit 1 Cycle 10 because the CEA will be replaced during the next refueling outage.

DISCUSSION

The Unit 1 Cycle 10 center CEA is a reduced strength CEA in that only one of five "fingers", the center one, serves any reactivity control function. The remaining four fingers are filled with aluminum oxide pellets with a zircaloy slug at the bottom of each finger. This CEA was designed for use in the center of the 24-month cycle core to provide power distribution control early in the cycle. Three similar CEAs have previously been used, one during Unit 2 Cycle 8, one during Unit 2 Cycle 7, and one during Unit 1 Cycles 8 and 9. The Unit 2 Cycle 8 center CEA was found to have exhibited swelling behavior in the zircaloy slug region after one 24-month cycle of operation, and was replaced with a new CEA of a different design for the next cycle. Upon discovery of this swelling, the center CEAs that had been removed from the Unit 1 Cycle 8 and 9 (two 18-month cycles) cores and the Unit 2 Cycle 7 (one 18-month cycle) core were also examined in the spent fuel pool. From information gathered during the examination, we concluded that the potential existed for swelling in the center CEA presently residing in the Unit 1 core (Unit 1 Cycle 10). A decision was made at that time to remove the CEA during the next Unit 1 refueling outage and replace it with one that does not contain zircaloy slugs.

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Unit 1 was shut down on February 2, 1991, for reasons unrelated to this issue. While the shutdown was underway, it was noted that the rod bottom light and lower electric limit light had not come on for the center CEA after it had been driven into the core. The CEA was withdrawn approximately 4-6 inches and dropped back into the core to see if it would seat. Again it did not seat, although the lower electrical limit indication came on. At this time, commencement of reactor coolant system (RCS) cooldown was delayed to allow for more testing. Readings of the CEDM coil traces were taken to determine the existence of CEA binding. These readings indicate that the CEA is binding in the buffer region of the guide tube. This binding is most probably due to swelling of the zircaloy slugs, similar to swelling experienced before and described above (see Table 1). We request that Unit operation be allowed to resume with this swollen CEA, since the reactivity of this CEA is sufficiently low that it does not impact the safety analysis.

The swelling is believed to be due to the same mechanism found to exist in the other center CEAs with zircaloy slugs. The other CEAs had shown swelling mostly in the interface region between the zircaloy slug and the aluminum oxide pellets, but also elsewhere along the slug. This swelling is due to the hydriding of the zirconium which occurs when it comes in contact with free hydrogen. In this CEA, the swelling that is occurring in the lower region of the zircaloy slug is causing interference with the buffer region of the guide tube (see Figure 1). As indicated above, this center CEA will be replaced during the next refueling outage with a CEA which does not contain zircaloy slugs. The current center CEA in Unit 2 does not contain zircaloy slugs.

The proposed changes to Technical Specifications 4.1.1.1.1, 4.1.1.2, 3.1.3.1, 4.1.3.1.1, 4.1.3 1.2, 4.1.3.1.3, 3.1.3.3, 4.1.3.3.1, 4.1.3.3.2, 3.1.3.4, 4.1.3.4, 4.1.3.5, 3.10.1, 4.10.1.1, and 4.10.1.2 consist of a footnote which excludes the applicability of the Technical Specifications to the center CEA for Cycle 10. Technical Specifications 3.1.3.6 and 4.1.3.6 do not specifically deal with single CEAs. However, a footnote was added to permit the exclusion of the center CEA from the determination of Bank 5 position. The proposed changes to Technical Specifications 3.2.2.1, 4.2.1.3, 4.2.2.1.3, 4.2.2.3, 3.2.3 and 4.2.3.3 consist of a footnote which permits exclusion of the center CEA from the stated full length CEA insertion limit.

JUSTIFICATION

The safety analyses identify the minimum plant conditions assumed for operability and alignment of control element assemblies to ensure that 1) acceptable power distribution limits are maintained, 2) the minimum shutdown margin is maintained, and 3) the potential effects of a CEA ejection accident are limited to acceptable levels. Potential impacts on the physics parameters that define these criteria which would result from the inoperability or misalignment of the center CEA, are discussed below.

Calvert Cliffs is operated in essentially an all-rods-out (ARO) condition. As such, the power distributions used to generate the physics data input to the safety analyses, although they reflect appropriate rodded configurations, are based on the assumption of an essentially ARO condition. Thus, the effect of the center CEA being misaligned at the extreme of full-in for the balance of Cycle 10 on the Unit 1 Cycle 10 power distributions was evaluated. This evaluation demonstrated that there were only minor differences between the ARO power distributions and those with a misaligned center CEA and that these differences were insignificant.

Anomalous operation of the center CEA would only affect the power distribution related physics data, which are input to safety and setpoint analyses to determine acceptable power distribution limits, if such operation resulted in a misalignment of the center CEA from the rest of Bank 5. The consequences of such a misalignment of the center CEA were evaluated using the power distribution limit related physics data input to the safety and setpoint analyses for Cycle 10. The review indicated that the only power distribution limit related physics data which could be compromised by misalignment of the center CEA were radial and axial power peaking data, hot full power (HFP) dropped CEA data, excore detector response due to Bank 5 movement, and other HFP CEA withdrawal data.

A misaligned center CEA would not be expected to result in a significant perturbation of the Unit 1 Cycle 10 core power distribution for the following reasons. First, the reactivity worth of the center CEA is relatively small because of its low strength design (four Al_2O_3 fingers and only one B_4C finger) and because it is inserted into a twice burned fuel assembly. Second, a misalignment of the center CEA from the rest of its bank will not create a core tilt since it is located exactly in the center of the core. This expectation was verified by evaluating the effects of the center CEA being misaligned, either full-out or full-in upon:

- the radial and axial peaking data input to the Unit 1 Cycle 10 setpoint analysis;
- the HFP dropped rod physics data input to the Unit 1 Cycle 10 dropped CEA analysis;
- the excore detector response due to Bank 5 movement data for Unit 1 Cycle 10 and other HFP CEA withdrawal physics data input to the HFP CEA withdrawal analysis for Unit 1 Cycle 10.

For all but the axial power peaking data, the effect of the center CEA being misaligned at the extremes of full-out or full-in was used to bound the actual effects of the center CEA being misaligned between full-out and full-in. For the axial power peaking data, it was necessary to combine intermediate misalignments with full-out and full-in misalignments to fully evaluate the potential impact. All of these evaluations concluded that misalignment of the center CEA would not invalidate the power distribution limit related physics data input to the safety and setpoint analyses supporting the operation of Unit 1 during Cycle 10.

The shutdown margin physics data used in the safety and setpoint analyses supporting Unit 1 Cycle 10 was reviewed for possible compromises due to the inoperability or misalignment of the center CEA. This review indicated that the only shutdown margin related physics data which could be compromised by the inoperability of the center CEA (failure to insert upon a scram signal) or misalignment (loss of shutdown margin due to excessive pre-trip insertion) were the scram and steam line break (SLB) cooldown reactivity insertion data. Consequently, the Unit 1 Cycle 10 scram and SLB cooldown physics data were recalculated assuming the center CEA does not trip upon demand (in addition to using the standard assumption that the worst rod remains stuck full-out). The resulting data was compared to the physics data used in the Unit 1 Cycle 10 safety analyses. This comparison determined that the scram and SLB cooldown physics data used in the Unit 1 Cycle 10 safety analyses can be satisfied without taking credit for the center CEA.

Anomalous operation of the center CEA would only affect the CEA ejection related physics data, which are input to safety analyses, if such operation resulted in misalignment of the center CEA from the rest of Bank 5 at HFP. The consequences of a misalignment of the center CEA on the physics data input to HFP CEA ejection analysis were evaluated. The evaluation concluded that misalignment of the center CEA has no significant effect on the CEA ejection physics data.

In addition to the above, all other physics data input to safety analyses were reviewed with respect to the potential consequences of a misalignment of the center CEA. This review indicated that all other data were unaffected.

Bank 5 position is input to the INCA incore detector monitoring system. Therefore, the consequences of a misalignment of the center CEA on the INCA system were evaluated. It was determined that the values of F_{xy} and F_t determined by INCA would be affected by a misalignment of the center CEA. These values will be adjusted to compensate for any misalignment.

The results of these evaluations demonstrate that the operability and alignment of the center CEA is not required during Unit 1 Cycle 10 normal or transient plant operating conditions. The safety and setpoint analyses supporting Unit 1 Cycle 10 were all determined not to be invalidated by the misalignment or inoperability of the center CEA. Thus, it can be concluded that Cycle 10 may operate with the center CEA in any axial location without impacting the existing safety analysis.

PROPOSED DETERMINATION OF NO SIGNIFICANT HAZARDS CONSIDERATIONS:

The proposed change has been evaluated against the standards in 10 CFR 50.92 and has been determined to involve no significant hazards considerations, in that operation of the facility in accordance with the proposed amendment would not:

(i) *involve a significant increase in the probability or consequences of an accident previously evaluated.*

The Technical Specification changes will allow plant operation with the center CEA excluded from operability and alignment requirements.. This in itself will not affect the operation of any other CEA or plant component. Thus, the changes will not increase the probability of failure of any other plant component. Also, since the center CEA will not be operated in a different fashion than before except for possible misalignment, this change will not increase the probability of the failure of the center CEA itself. Therefore, the probability of occurrence of an accident previously evaluated is not increased. The consequences of accidents previously evaluated are not increased since, as shown in the safety analysis, none of the physics data input to the current licensing analyses for Unit 1 are invalidated due to removing the operability and alignment requirements of the center CEA.

(ii) *create the possibility of a new or different type of accident from any accident previously evaluated.*

The Technical Specification changes will not affect the operation of a plant component other than the center CEA. The center CEA will not be operated differently than before. The misalignment of the center CEA creates new CEA configurations which have been considered, but it does not create new event scenarios. We have evaluated the possibility that the CEA swelling could induce irradiation assisted stress corrosion cracking (IASCC). The cladding material in this CEA is ductile because it is a new CEA in its first Cycle 0 operation, and is not susceptible to the IASCC-related problems in high exposure CEAs.

(iii) *involve a significant reduction in a margin of safety.*

None of the physics data input to the current licensing analyses for Unit 1 are invalidated due to removing the operability and alignment requirements of the center CEA. Thus, all the licensing analyses remain valid and the existing margin of safety is preserved.

STATEMENT OF EMERGENCY CIRCUMSTANCES

The Technical Specifications, unless amended, would prevent Unit 1 from starting up on time. Currently, Unit 1 is expected to enter MODE 2 on February 9, 1991. The center CEA has been declared inoperable because of our inability to determine that it will continue to satisfy the rod drop time surveillance requirements. Because of this, we do not meet the Limiting Conditions for Operation of Technical Specification 3.1.3.4 and the Unit cannot enter MODE 2. The conditions leading to this situation could not have been reasonably anticipated. Evaluations were performed of observed swelling in other similar CEAs and correlations were made between observed swelling and length of operation. These evaluations did not indicate that it was likely that we would experience any interference during Unit 1 Cycle 10 operation. This CEA has been fully inserted several times during the current cycle, and has shown no indication of interference. We could not have avoided this situation because the Unit was already operating in the current cycle when the swelling problem was discovered. The only way to avoid the problem would be to remove the CEA, which will be done during the next refueling outage.

SAFETY COMMITTEE REVIEW

These proposed changes to the Technical Specifications and our determination of significant hazards have been reviewed by our Plant Operations and Off-Site Safety Review Committees, and they have concluded that implementation of these changes will not result in an undue risk to the health and safety of the public.

Very truly yours,

GCCreel

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

I hereby certify that on the 8th day of February, 1991, before me, the subscriber, a Notary Public of the State of Maryland in and for Calvert County, personally appeared George C. Creel, being duly sworn, and states that he is Vice President of the Baltimore Gas and Electric Company, a corporation of the State of Maryland; that he provides the foregoing information for the purposes therein set forth; that the statements made are true and correct to the best of his knowledge, information, and belief; and that he was authorized to provide the information on behalf of said Corporation.

WITNESS my Hand and Notarial Seal:

Donna L. McCready
Notary Public

My Commission Expires:

January 1, 1994
Date

GCC/ERG/PSF/dlm

Attachment

cc: D. A. Brune, Esquire
J. E. Silberg, Esquire
R. A. Capra, NRC
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T. T. Martin, NRC
L. E. Nicholson, NRC
R. I. McLean, DNR
J. H. Walter, PSC

TABLE 1

AMOUNT OF SWELLING IN CENTER CEA

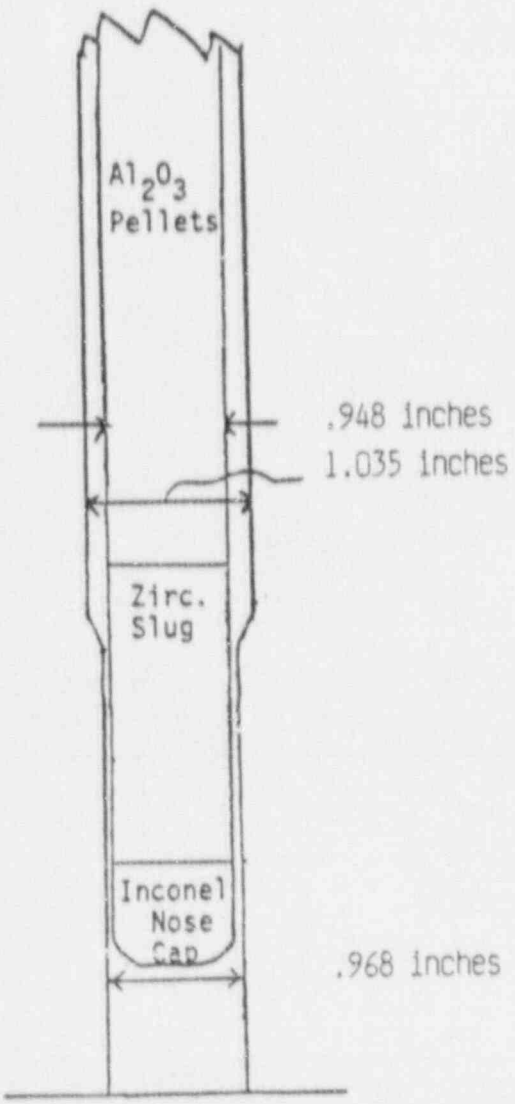
Center Rod	Length of Operation	Maximum Diameter* (inches)
Unit 2, Cycle 7	18 Months	<.950 **
Unit 2, Cycle 8	24 Months	.979
Unit 1, Cycles 8 & 9	36 Months	.986

* These maximum occurred near the top of the slug. Some swelling also occurred near the bottom of the slug, but did not cause interference.

** No swelling occurred at either the top of bottom of the slug.

FIGURE 1

CEA Fully Inserted in Guide Tube



CEA Binding in Guide Tube Buffer Zone