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

May 25, 2000

MEMORANDUM TO: Marsha Gamberoni, Acting Chief, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

FROM: Alexander W. Dromerick, Sr. Project Manager, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

SUBJECT: DRAFT QUESTIONS AND RESPONSES - CONTAINMENT TENDON LONG-TERM CORRECTIVE ACTION PLAN (TAC NOS. MA7782 AND MA7783)

Attached is BGE's draft response to our draft RAI's regarding containment tendon long-term corrective action plan for Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2.

Attachment: As stated

1. *The third item of your Containment Tendon Long-Term Corrective Action Plan provided in Reference 2 states, in part, that by December 31, 2000, BGE will replace all severely corroded vertical containment tendons (i.e., 63 of 202 vertical tendons in Unit 1 and 64 of 204 vertical tendons in Unit 2) with new tendons. However, in your revised Containment Tendon Long-Term Corrective Action Plan (Reference 1) you stated, in part, that after reviewing the final report for the 1997 inspections, it was determined that 123 of 202 vertical tendons from Unit 1, and 130 of 204 vertical tendons from Unit 2, did not have indications of severe corrosion. This statement seems to imply that, based on your more recent review of the 1997 final inspection report, there are 79 (202-123=79) and 74 (204-130=74) severely corroded tendons for Units 1 and 2, respectively. Please explain the above numerical discrepancies with respect to the numbers of so-called "severely corroded tendons" identified during the two different review performed on the 1997 tendon inspection data.*

BGE Response

The initial Containment Tendon Long-Term Corrective Action Plan, dated May 14, 1998, was submitted prior to the final disposition of the nonconformance reports from the 1997 inspection. In our initial plan, we stated that the **estimated** number of severely corroded tendons was 63 for Unit 1 and 64 for Unit 2. This estimate was based on verbal day to day communication with the vendor during the 1997 inspection. Subsequent to the May 14, 1998 submittal, we received the Final Report for the 1997 Containment Post Tensioning System Inspection from our vendor. During the preparation of the Final Report and review of the documentation for the 1997 inspection we determined that the final number of severely corroded tendons for Unit 1 was 79 and for Unit 2 was 74. The initial Containment Tendon Long-Term Corrective Action Plan was submitted prior to the final review of the data being complete based on deadlines of the NRC letter dated January 23, 1998. The differences in the numbers between the May 14, 1998 letter and the December 7, 1999 letter is due to the review of the 1997 inspection data report.

2. *Assuming that you have adopted a more or less consistent criteria in judging the severity of tendon corrosion during the two different review occasions, does the above noted discrepancies (i.e., from 63 to 79 and 64 to 74 tendons for Units 1 and 2, respectively) suggest a rather rapidly progressing degradation rate for Units 1 and 2 tendons? What is the engineering basis for your proposed relaxation with respect to the contents of the Calvert Cliffs Containment Tendon Long-Term Corrective Action Plan? Please address this issue from the standpoint of both the relaxation in criteria for tendon replacement and the proposed postponement in tendon replacement schedule, and potential effects on Calvert Cliffs' containment integrity.*

BGE Response

As described in the above response, the differences in the number of severely corroded tendons between the May 14, 1998 letter and the December 7, 1999 letter do not signify a change in degradation rate. The visual inspection performed in 1999 did not show any indications that our degradation rate was more severe than that predicted. The engineering basis for our proposed action plan continues to be derived from our engineering evaluation report provided to the NRC in the October 28, 1997 submittal. The engineering evaluation determined that the wire failures were caused by corrosion that had been occurring for many years, perhaps since plant construction. The follow up inspection confirms this predication. We believe the short-term corrective actions taken during the 1997 inspection have slowed this corrosion. Containment integrity is based on

the lift off values measured during the 1997 inspection for the vertical tendons, which showed that they are capable of providing the required force to the containment such that the containment can perform its safety function.

Our May 14, 1998 response was subject to limited data, namely only one set of visual inspections completed in 1997. Because of limited data points, BGE adopted a conservative approach to ensure integrity of the containments. Upon further review and additional inspection results gathered in 1999, BGE has additional data to support that the degradation of the tendon wires is a long-term process, and that the conservative actions previously planned were no longer necessary in a short time period. We revised our course of action to allow additional data gathering and to perform necessary analyses to determine which, if any, vertical tendons need to be replaced. This alternate course of action provides a more cost beneficial and deliberate resolution while always ensuring we exceed our design requirements. The engineering evaluation of the degraded containment prestressing systems is based on the lift off values measured during the 1997 inspection for the vertical tendons.

3. *Under the first paragraph of Justification for the Containment Tendon Long-Term Corrective Action Plan of Reference 2, you stated that "Our long-term plan does not rely on the statistical prediction of wire breakage." Yet, the last part of your second item of Reference 1 indicates that you still intend to use a questionable statistical distribution (Weibull distribution) and a set of generally unsupportable assumptions to make an engineering prediction. The above-noted statements seem to present an inconsistent BGE position. BGE is, therefore, requested to use a deterministic based engineering analysis or a statistical approach supported by adequate and credible inspection data to draw its safety conclusion regarding the adequacy of its degraded containment prestressing systems.*

BGE Response

BGE is not relying solely on a statistical model to ensure containment integrity. We will perform additional visual inspections of tendon anchorages to confirm the rate of wire failures.

In order to ensure that the containments continue to perform their intended safety function while corrective actions are being planned, scheduled, and conducted, we found it necessary to attempt to quantify an appropriate degradation rated to use in the deterministic analyses. We considered a number of options for determining an appropriate degradation rate including:

1. Crediting regreasing so that the future degradation rate would be zero.
2. Linearizing past failure observations so that the rate would be 226x wires divided by 23 years for a rate of 10 x wires per year.
3. Modeling the corrosion mechanism in a statistical failure model.

While options 1) and 2) are deterministic methods, we determined that they were neither accurate, nor conservative. Instead we applied what we believe is the standard and appropriate method to most accurately evaluate corrosion degradation of components. The statistical distribution used in our model (the Weibull distribution) is not a questionable distribution. Instead it is the leading method in the world for fitting life data, and is applied over a vast variety of engineering failure prediction situations. We developed two containment tendon Weibull models. Both used actual tendon data, with

one using general pre-stress wire corrosion failure data for the Weibull slope and one using steam generator tube degradation data to select the Weibull slope. The model built using the latter data was conservative with respect to tendon degradation. Because of the conservatism in the steam generator tube based model we believe characterization of the use of steam generator tube data as an unsupportable assumption is not accurate. We have since refined a Weibull model based solely on tendon degradation data (including the Weibull slope) that couples the conservatism of the earlier steam generator tube based degradation model with actual inspection results.

BGE does not rely solely on a statistical model to determine the adequacy of the containment tendon prestressing system, or for corrective action planning. Nevertheless, the statistical model is used to characterize the degradation rates for input into deterministic analyses. The statistical approach is supported by adequate, credible inspection data.

4. *Given the continuing tendon degradation noted above, please provide your assessment that this continuing degradation of the containment prestressing systems with its consequential reduction in design margins originally established per the applicable FSAR criteria for both Units 1 and 2 would not constitute an unreviewed safety question (USQ) pursuant to 10 CFR 50.59.*

BGE Response

BGE is addressing the issue of containment tendon corrosion as a degraded condition subject to our 10 CFR Part 50 Appendix B Corrective Action Program. Our correspondence regarding the corrective action plan associated with this condition has been provided to facilitate NRC staff's understanding of the adequacy of our corrective actions and the technical basis for it. This process approach is consistent with the guidance provided in NRC Generic Letter 91-18 Revision 1, which notes that 10 CFR 50.59 is applicable to this scenario only:

- If the condition is accepted "as-is" resulting in something different than described in the SAR, or
- If an interim compensatory action is taken to address the condition and involves a procedure change or temporary modification.

As discussed above, our final corrective actions are still under development. The end state will not be determined until after evaluation of the data from inspections later this summer. We expect to complete that evaluation by October. If as a result of that evaluation (or any subsequent development) we decide to accept "as-is" an end state different than that described in our UFSAR we will evaluate that condition in accordance with 10 CFR 50.59. We do not intend to invoke any temporary procedure changes or plant modifications; therefore, we believe applying the criteria of 10 CFR Part 50, Appendix B, Criterion 16 for timely correction of the conditions commensurate with their safety significance is the applicable regulatory process, not 10 CFR 50.59.

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