NRC PDR

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

SEP 0 7 1979

Docket No. 50-339

Mr. W. L. Proffitt
Senior Vice President - Power
Operations
Virginia Electric & Power Company
P. O. Box 26666
Richmond, Virginia 23261

Dear Mr. Proffitt:

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION

To continue our review of your application for a license to operate the North Anna Power Station, Unit 2, additional information is required. The information requested is described in the Enclosure. The information requested in the Enclosure is based on our evaluation of information submitted by Westinghouse related to their experience with guide thimble tube wear (see Reference 1, 3 and 5 listed in the Enclosure).

To maintain our licensing review schedule, we will need a completely adequate response to the enclosed request by September 21, 1979.

Please inform us after receipt of this letter of your confirmation of the above date or the date you will be able to meet.

Sincerely,

Olan D. Parr

Olan D. Parr, Chief
Light Water Reactors Branch No. 3
Division of Project Management

Enclosure:
Request for Additional Information

cc w/enclosure:
See next page

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ENCLOSURE

REQUEST FOR ADDITIONAL INFORMATION

NORTH ANNA POWER STATION, UNIT 2

DOCKET NO. 50-339

4.0 Reactor

4.17 Please provide the basis and derivation of the guide thimble wear model described in Reference 1.* In particular, explain assumption 4 and the equations provided under assumption 7. Does the model predict maximum local wear or average circumferential wear?

4.18 Using the guide thimble wear model, Westinghouse has predicted maximum stresses and stress intensity limits for worn guide thimble walls in two fuel assembly designs, which were subjected to a 6g handling load. These calculated values are listed in Table 4.1 of Reference 1. We note that the stress intensity limits increase as a function of time for both fuel assembly designs and that the limits always remain greater than the maximum stresses, which increase as the wall is worn away. From the supporting discussion preceeding Table 4.1, it is not clear if the stress intensity limits are time dependent. Such an assumption would explain the noted increase in stress limits, but does not address the decreasing material toughness, associated with irradiation hardening. If such credit is being used, it is contrary to the previous Westinghouse position in Reference 2 and item 4.0.5 of Reference 1. Please clarify whether or not Westinghouse has taken credit for irradiation strengthening. Show that the criteria adopted represents the more conservative approach.

4.19 Guide thimble wear data, which were taken from Point Beach Units 1 and 2 spent fuel, are discussed, listed, and plotted in Section 2.3, Table 2.1, and Figure 5, respectively, of Reference 1. Please confirm that the time units in Section 2.3 and Table 2.1 are in error and make corrections as needed. Should not the units be days instead of hours?

*Incorporate this information by reference in your response.

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4.20 Submitted Westinghouse information does not explain why the guide thimble wear model, which was developed from measurements taken on two 2-loop plants with 14x14 fuel assemblies, is applicable to wear predictions on plants of other designs. Other NSSS-vendor-designed plants have experienced a "plant-specific" and "core-position" dependence in the observed wear. Therefore, please explain how the model accounts for wear differences and provide supporting data for all Westinghouse design variations. If the analytical treatment of design variations are justified, the supporting data can be provided in a confirmatory manner after NRC approval of the model. Please provide details of your data-gathering proposal, a schedule for its implementation, and state your commitment to carry out this confirmatory program. This data-gathering program should be completed expeditiously considering the availability of irradiated assemblies in all Westinghouse plants.

4.21 In Reference 3*, Westinghouse stated that the effect of hydrogen content on the mechanical properties of Zircaloy is discussed in WCAP-9179 (Reference 4). We have reviewed that topical report and found no information on this issue. Please provide your evaluation of how this consideration affects the safety analysis. Include in this evaluation a description of the propensity for hydrogen uptake of the Zircaloy as a function of the accumulative wear.

4.22 When eddy current testing was conducted on worn guide thimble tubes from the Point Beach Units, did the presence of zirconium hydrides affect the results? How sensitive is the interpretation of eddy current signals to hydride presence? How is this effect taken into account?

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*Incorporate this information by reference in your response.

4.23 References 1, 3, and 5* do not address the consequences of hole formation in worn guide thimble tubes. Moreover, it is not clear from the submitted information if Westinghouse (1) has observed holes during inspection of the 49 guide thimbles tubes that were examined in the Point Beach spent fuel, or (2) has predicted (with the guide thimble wear model) hole formation to occur during projected fuel lifetime. Please clarify. Also, if holes have been observed or are anticipated, provide a discussion on the impact of such holes on guide thimble tube integrity, control rod motion, and thermal-hydraulic performance. This discussion should also account for flow-induced vibration resulting in crack propagation and possibly fatigue fracture in locally thinned areas of the thimble wall. This discussion should address the integrity of the thimble tubes during the entire core residence time; both during periods of wear (under RCCA) and when the fuel assemblies are not under RCCAs.

4.24 During the review of WCAP-9179 (Reference 6), the staff questioned the Westinghouse value for the ultimate tensile strength of Zircaloy components. The subsequent Westinghouse response (Reference 2) stated that the ultimate tensile strength of Zircaloy was <u>not</u> used in the design analyses of present fuel assembly designs. However, the analysis contained in Reference 1 uses the ultimate strength as a limiting variable. Therefore, please submit for review the Westinghouse correlation for the ultimate tensile strength of Zircaloy.

*Incorporate this information by reference in your response.

4.25 Section 4.1 of Reference 1 states that the stress intensity factors are plotted as a function of time for 14x14 and 17x17 fuel assemblies in Figure 5. This is not true. Please provide such a figure or amend Figure 5 as necessary.

4.26 Per item 4, Section 4.0 of Reference 1, your analyses are based on uniform wear in all thimble tubes. Address the margin of conservatism for this assumption. Compare your results with an analysis that considers non-uniform wear resulting in a shift of the neutral axis. Note that such shifts will result in both direct stress and bending stresses.

4.27 For Condition-1 and -2 load analyses of Reference 1, a skew factor is mentioned that accounts for the uneven axial load distribution. Clarify how the skew factor is related to both geometric changes (resulting from uneven wear) and assembly misalignment. How does the skew factor impact the load analyses?

4.28 The equation for the wear volume in Reference 1 appears linear with time. However, in Figures 5 and 6, wear depth is plotted versus time, and the resulting correlation appears to be non-linear. Please provide information on how these parameters are related.

4.29 For Condition-3 and -4 load analyses described in Reference 1, it is stated that the stresses in a worn guide thimble tube are based on generic stress calculations. Please reference where these generic stress calculations can be found. It is also stated that the stresses in the unworn guide thimble tubes are increased to account for the reduction of the tube cross section due to the wear scar. This would indicate credit for a load redistribution to the unworn guide thimble tubes. Is a skew factor employed in the Condition-3 and -4 load analyses? Describe the state of stress in the worn guide tubes and how the uneven wear affects the load-bearing characteristics of the worn tubes.

ATTACHMENT

References

1. T. M. Anderson (W) letter (NS-TMA-2102) to D. G. Eisenhut (USNRC), dated June 27, 1979.

2. T. M. Anderson (W) letter (NS-TMA-1985) to J. F. Stolz (USNRC), dated November 10, 1978.

3. T. M. Anderson (W) letter (NS-TMA-1936) to D. G. Eisenhut (USNRC), dated September 12, 1978.

4. P. J. Kuchirka, "Properties of Fuel and Core Component Materials," Westinghouse Electric Corporation Report, WCAP-9179, Rev. 1, dated July 1978.

5. T. M. Anderson (W) letter (NS-TMA-1992) to D. G. Eisenhut (USNRC), dated December 15, 1978.

6. P. J. Kuchirka, "Properties of Fuel and Core Component Materials," Westinghouse Electric Corporation Report, WCAP-9179, dated October 25, 1977.