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U.S. Nuclear Regulatory Commission
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Washington, DC 20555

Attention: Mr. J. S. Wermiel, Chief
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Ms. M. S. Chatterton
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Subject: **Westinghouse Topical Report SER Requirements**

The purpose of this letter is to provide supplemental information regarding two Westinghouse topical reports and their respective SERs. Westinghouse Corrective Action Program recommended that the NRC be informed of these items from an information only standpoint. The enclosed items are: 1) the minimum specification sintering time as it relates to the fuel densification model, and 2) the fluid condition limitations for THINC-IV.

The attached information is provided, *for information only*, to document Westinghouse's current practices as they relate to these two items. There is no request for action or review on the part of the NRC staff.

Westinghouse is available to answer any questions related to this item upon NRC request. Questions should be addressed to J. J. Akers at 412-374-4865.

Very truly yours,

H. A. Sepp, Manager
Regulatory and Licensing Engineering

WHS/pac
Attachment

cc: M. Scott, NRR 1A
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Attachment A

Minimum Specification Sintering Time (WCAP-8218-P-A)

Per the SER, it is stated that "The report provides acceptable fuel densification effects in pressurized PWR fuels that have been manufactured within the processing bounds described in the report. ... for recent Westinghouse fuel fabricated at higher sintering temperatures and higher densities, the new model does not contain excessive conservatism. Therefore, it is emphasized that the new model applies only to fuel fabricated within the envelope of fabrication conditions from which the empirical expression was derived. This is true not only for the explicit variables, initial density and sintering temperature, but also for implicit variables such as sintering time. For fuel whose manufacturing parameters differ from those of this fabrication envelope, the fuel densification model is not applicable."

During the licensing process of WCAP-8218-P-A, the staff requested clarification of the sintering time. Westinghouse indicated that the minimum manufacturing specification sintering time was 5 hours. The empirical expression was actually based on fuel with sintering times of 3 to 5 hours which was also stated in the response to the RAI. Subsequently, Westinghouse reduced the minimum manufacturing specification sintering time from 5 hours to 4 hours. This change was based on detailed analyses and metallurgical examinations of the fuel pellet grain structure to reverify what was documented in the original analysis that the change in sintering time would not affect fuel pellet performance. The change from 5 hours to 4 hours is within the SER requirements, but differ from the value noted in the response to the RAI (e.g., minimum manufacturing specification of 5 hours). The 4 hours is within the 3 to 5 hour database that formed the basis of the empirical expression, as noted in the SER and is therefore considered acceptable.

Fluid Condition Limitations for THINC-IV (WCAP-12330-A)

Per the SER, it is stated that "As a result of our review of WCAP-7956 and WCAP-8054, we have concluded that the THINC-IV computer code is acceptable for performing steady-state hydraulic calculations in reactor cores provided suitable conservative assumptions are used with respect to plant operating conditions, fuel fabrication tolerances, and power peaking uncertainties. Fluid conditions are limited to the single phase or the homogeneous two phase flow regime because of the models used for lateral flow diversion and mixing are based upon a single-fluid formulation without slip."

Fluid conditions may not be limited to single phase or homogeneous two phase flow. THINC-IV does not identify which flow regime the calculations are being done in based on the input conditions. Based on the permissible fluid conditions allowed for the DNB correlations (WRB-1 and WRB-2), it is possible to exceed the fluid conditions permitted in THINC-IV as noted by the SER restriction above. However, it has been shown that for these types of conditions where the calculations are outside the flow regime conditions specified, THINC-IV accurately predicts acceptable results. This confirmation was done utilizing WESTAR. The WESTAR code has been approved for use in analyzing PWR cores by the NRC, Reference 1. This code is based on a three dimensional drift-flux

model with an advanced two phase flow description and thus is applicable to non-homogeneous two phase flows. WESTAR has been compared to THINC-IV over a wide range of thermal-hydraulic conditions that give low values of DNBRs, Reference 2, Tables 4.3 and 4.4. The results of these comparisons show that WESTAR and THINC-IV predictions of DNBRs are very close to each other. Thus, THINC-IV will give accurate predictions of DNBRs for the reactor core safety analyses where it is applied including those for non-homogeneous two phase flows. Thus, it is viewed that this situation is not a concern based on extensive benchmarking to WESTAR (documented in the addendum to THINC-IV), which is qualified to calculate DNB conditions for other flow regimes. While WESTAR is an approved code, it has not been referenced in licensing applications, where fluid conditions are outside the THINC-IV flow regimes.

In reviewing the conclusions documented in the SER, it is stated that "the comparison also indicated that, for other conditions corresponding to higher power densities, the previous THINC-IV methodology may not provide acceptable results. These comparisons also indicated that the improved THINC-IV methodology provides acceptable results for all conditions which were considered, both typical of previous applications and attendant to higher power densities." Based on the high power density comparisons of Improved THINC-IV, WESTAR and COBRA-IIIC/MIT and the above statement made in the SER Conclusion, the current application of Improved THINC-IV is considered acceptable.

References:

1. WCAP-10951-P-A, "WESTAR: An Advanced Three-Dimensional Program for Thermal-Hydraulic Analysis of Light Water Reactor Cores," June 1988.

2. WCAP-12330-A, "Improved THINC-IV Modeling for PWR Core Design," September 1991.