Powers

(11)

20 December 1979

NUREG
0630
Comments

Mr. Dale A. Powers
Reactor Fuels Section
Core Performance Branch
Division of Systems Safety
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: NUREG-0630

Dear Mr. Powers:

At your insistence, I have reviewed report NUREG-0630 (Cladding Swelling and Rupture Models for LOCA Analysis) authored by you and R. O. Meyer. As I cautioned you during our phone conversation of a few weeks ago, I have not been involved in this area of work during the past five years nor have I kept abreast of ongoing programs. Therefore, my comments reflect only my early 1970's knowledge and the additional information presented in your report.

Firstly, I wish to compliment you on your report and the analyses contained therein. I am in general agreement with your treatment, correlations, and discussion. My comments to follow relate to material presented in pages 12 through 27. Perhaps they may be helpful to you in future analyses.

- The assignment of the 775°C α-phase peak maximum strain value might be better justified through use of a statistical treatment of the data to obtain an upper bound limit with, for example, 95% confidence. However, in the interim I would accept your selection of 80% circumferential strain. An additional comment is to the three test points, evidently from three different test series, which are above your curve (Figure 6) in the 850 to 925°C range. Should the peak be broadened to incorporate these? (I realize this might detract slightly from the correlation with Chung and Kassner's data.) A higher peak height would probably also bring them more into line.

- Your fast-ramp correlation (p. 15 and Figure 7) would appear better if you would, as you noted you are considering, shift the α-phase peak to a higher temperature. Evidently, you have used different methods for defining the low and high temperature peaks. Perhaps one would do well here to define the entire curve using only the raw data and, as indicated earlier, a statistical treatment. By then working backwards through Figures 5 and 6 one could show a more-or-less good fit for the low temperature peak. However, how does one reconcile the value for the high temperature peak (Figure 7) with the data of Figure 5.

- Your empirical method of determining a factor correlating average rupture strain and "local" assembly blockage appears suitable. I assume, however, that such a factor would vary with array size and that you will check further as other data become available.

- I agree that an adjustment to "local blockage" is necessary in obtaining "bundle-average blockage." Ideally, the adjustment should be made through an experimentally determined relationship between blockage and array size (i.e., 2 × 2, 3 × 3, 4 × 4, etc). I realize, however, that it would be a monumental task to obtain such a relationship and, therefore, that some other method of adjustment is desirable. However, I do not see the real justification for adjustment on the basis of the "average blockage for Chapman's bundle tests." One might give some thought to an analysis of the distribution of individual flow channel blockages to the average blockages in arrays of small size (i.e., relationship of individual channel blockages in a four-channel, 3 × 3 array, to the array-average blockage versus individual channel blockages in a nine-channel, 4 × 4 array, to their respective average). Alternatively, one might be able to do something based on the statistics of the axial distribution of ruptures/strains. (I trust you are now sufficiently confused.) In the interim, one could omit this adjustment and use the available test data to demonstrate the degree of conservatism.

- Your second adjustment to blockage (p. 27) appears reasonable.

You indicated in your cover note to the subject report that "formal comments" may be included in the final report. I would prefer that the comments I have made be treated as "informal" and for your consideration only.

Very truly yours,

P. L. Rittenhouse

PLR:jst

cc: G. M. Slaughter
D. B. Trauger

Request withdrawn per D.B. Trauger Telecon to D.A. Powers on 3/11/80.