SD

ET-12-16

May 8, 1980

TO: S. Duraiswamy

FROM: I. Catton

SUBJECT: ECCS and Natural Circulation Subcommittee Meetings, 25-26 March 1980

During the two day meeting a number of questions arose. In that natural circulation is a part of ECC, I didn't try to separate the two. The comments in the following paragraphs apply to both subcommittee meetings.

The Westinghouse small break analysis for UHI plants, WCAP-9369, and the staff review of their analysis were quite informative. For the most part both the analysis methodology and the results appear quite reasonable. Some questions and comments arising after review of WCAP 9369 that were not answered during the meeting as well as some arising during the meeting are as follows:

1. A large amount of cold water (UHI) entering the upper part of the core when it is partially voided will certainly lead to multi-dimensional motion. Both Westinghouse and the staff should be requested to verify that one-dimensional drift-flux modeling still applies. The tools for this exist. Westinghouse has a staff assessed code called THINC-IV that could be used and the staff, through RSR, has access to both COBRA-IV and TRAC. Reluctance to do so by both Westinghouse and the staff does not seem to be appropriate.

2. There are a number of ways to calculate the location of the froth level in the core during the period of core uncovery. The Wilson bubble rise model overpredicts the level (non-conservative) whereas the Zuber-Findlay work underpredicts the level (conservative). Both approaches have constants that can be, and are, adjusted. It is not clear what is done by Westinghouse nor is it clear how they justify what they do. A request for the details, with emphasis on experimental justification, should be made. This concern (or ignorance on my part) exists for the B&W as well as CE models as well as for the Westinghouse model.

3. If UHI actuation occurs during the single phase natural circulation phase of either an overcooling transient or a small break loss of coolant accident, (SBLOCA) the cold water injected from above may not only half the natural circulation, it may reverse the direction of the flow. During the period that the natural circulation is being re-established there will be a temperature overshoot because of the fluid inertia. The unanswered questions are a) what is the peak average temperature in the core and b) what is the peak clad temperature. It is possible that boiling may occur and overpressurization could lead to PORV or SRV actuations as a result of the flow transient resulting from UHI.

The technical aspects of the feed and bleed approach to handling a SBLOCA seems to be well in hand. If one has enough exit area for a given pump performance then feed and bleed can be a method of accident mitigation. The EPRI SRV study should answer questions about flow through a given exit area. It remains to see what a given plant pump performance is. If one then wants to use feed-and-bleed to mitigate a SBLOCA then they must make the changes needed.

Whether or nor one wants to use feed and bleed is another question. It seems to me that too much is being made of a relatively simple concept. Effort should be devoted to deciding if feed-and-bleed is desirable.

The question of non-condensible gas effect on the reflux mode of core cooling needs attention. The question of how well we need to know the heat transfer coefficient is still unanswered. Refluxing is basically a quasi-static process and all that is needed is confirmation that the process is efficient enough under all conditions. The need for detailed experiments is not justified when all codes in use are based on lumped parameter modeling. TRAC is presently too slow for SBLOCA analysis. Therefore it is my view that Semiscale or some similar facility ought to be used soon for a series of scaping experiments to determine how much non-condensible gas is necessary to degrade the reflux boiling mode of cooling to the point it is not sufficient to maintain core coolability. A bounding determination, such as carried out by Westinghouse, of how much non-condensible gas is available would dictate whether or not more detailed studies are necessary.