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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
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TO: Dr. Andrew Bates

FROM: Ivan Catton

SUBJECT: ECCS SUBCOMMITTEE MEETING MARCH 19-20, 1979, LOS ANGELES, CALIFORNIA

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A great deal of information on a number of subjects was presented at the two day meeting. I have tried to highlight what I feel are the important aspects of each part of the meeting. The following paragraphs contain my comments and suggestions rather than a detailed summary.

Code Work on Transient Two-Phase Flow. Code work on transient two phase flow is primarily embodied in TRAC for system analysis and COBRA for sub-channel analysis. The codes seem to have a sophistication that our understanding of there physical processes cannot match and may never match.

Dr. Wendroff discussed several aspects the ill-posedness question. His definition of a well-posed solution is particularly clear: for each data set there is a unique solution. Unfortunately there is little chance for any problem to pass the test. To get around this situation there are two schools of thought:

1. do whatever one must do to make the equations being solved pass the test,

2. don't worry about the problem - if the code runs count your blessings and if it doesn't renode.

It is not clear how a code like TRAC is made well-posed, if it is. It is suspected by some that the differencing algorithm causes a great deal of damping which helps. There is no way of knowing how much false dissipation occurs in TRAC.

I have a general concern. Some combinations of models and numerics seem to overcome what appear to be insurmountable difficulties (inherent instabilities associated with flow regime changes) by numerical damping. IT is difficult to decide where we are at.

Status of Physical Inputs to Codes. Dr. Fabic gave an excellant summary of where the data for code development will come from. Much of it is large scale experiments and much of it is foreign. It is possible that he will be

successful, but not without a great deal of effort. Few of the programs were designed to yield the information he is seeking.

The LASL presentation by Dr. Liles skirted the issue of transient flow regime behavior. Dr. Liles indicated that flow regime data was not needed directly because the codes were developed from first principles. There are no programs I am aware of that will yield data on phase interface area and its behavior during transient conditions. IF Dr. Liles position is the one under which TRAC is being developed, we have embarked on a life-time project. Its my feeling that NRC's view is not so all encompassing.

The work on the reflood model for TRAC seems to be a bit behind the state of the art. Dr. Kirchner does not seem to have all the available information. The inter-relationship between precursor cooling and Tmin resulting from the rate of change of temperature has lead to a great deal of difficulty for the code devleoper. A different flow regime changes the precursor cooling and can lead one into using the wrong Tmin. The result is inconsistant and undependable results.

Standard Problem Program. The basic idea of a standard problem program is a good one. It allows one to take the measure of a given vendors capability-grade him. There are, however, many difficulties associated with obtaining vendor participation. The vendor's codes are aimed at satisfying EM requirements whereas the standard problems are actual physical problems. There is no strong reasons for a vendor to become publicly involved with the program. As a matter of fact one can see many reasons why he does not.

Mr. Phillips of the staff indicated that the program does not have any requirements for participation. As a result, the primary participants in the program at present are those associated with licensing in the US and foreign countries. Little participation of US or foreign vendors is taking place. It is my belief that certain, if not all, standard problems should be used in the certification of the vendors code. This would maintain participation and continual code development within the vendor's technical groups. If the vendors are to participate, and I believe they should, then some better methods of inducement are needed. The equivalent of a standard problem program already exists within NRC as the code verification program. Without the vendors, a standard problem program is duplication of efforts.

ODYN Code Review. On the surface, the ODYN code appears to be adequate for the task it must address. It is a finite difference code and uses a difference algorithm that results in a highly damped result. This can be seen if one compares the measured results from Peach Bottom with the ODYN prediction. The measured results show pressure waves and expansion waves traveling back and forth in the steam line. Most of this structure is missing from the ODYN result. The response of compressible flow in a pipe to valve closure is usually determined using the method of characteristics

to avoid problems such as encountered in ODYN. The most important part of solution is the rate of pressure rise in steam dome of the vessel. The steam dome pressure reproduced fairly well. Its not clear what the limitations of the code are. This will not be a problem as long as the code is only used under circumstances where there is experimental verification.

Analysis of Semiscale Test S-07-6. There seem to be a number of efforts underway to predict the oscillatory behavior observed in S-07-6. Once the oscillatory process is initiated, it seems to carry forward on its own. Excess heat transfer is only a possible initiator of the process. It is my opinion that Flashing causes high flow into the pressure suppression tank and condensation in the lower plenum causes a high rate of flow back. Inertial effects cause an overshoot and the resulting excess pressure starts the process again. To analyze such a process one can treat the lower plenum as a bubble with an effective volume to account for condensation and arrive at a frequency that is not unreasonable. The slowly increasing amplitude is probably due to the pump adding energy to the flow. Under such circumstances, two solutions to the governing equations exist and all of the codes are written to pick the non-oscillatory solution. I believe it is a waste of time to pursue the problem further with codes like RELAP or TRAC.

Westinghouse 2-Loop and UHI Plants. The planned use of TRAC and COBRA to address the 3-D character of the W 2-Loop Plant upper plenum injection and upper head injection plants is the first realistic attempt at analyzing a very complex problem. The results of the two studies will be of interest both in the problems addressed and completing the development of some very useful tools.