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June 30, 1980

Dr. S. Fabic
U.S. Nuclear Regulatory Commission
Division of Reactor Safety Research
Mail Stop 1130 SS
Washington, D.C. 20555

Dear Stan,

I am writing my impressions of the last advanced code review group meeting. I found it, it general, very worthwhile. Let me organize my impressions into four catagories:

1) Proposed small break analysis

2) Code assessment for small breaks

3) Use of LOFT for small break testing

4) TRAC assessment

Enclosed, as a separate item, you'll find a proposed small break analysis program. I hope you'll xerox and send it to your friends because that's why I made it a free standing item. We are wasting time, I think trying to adapt large break analysis tools to small break problems. Lets use TRAC for large breaks and adopt a more appropriate proceedure for small breaks. I hope you give this proposal careful consideration.

Assessing how well the codes (models would be a better term) do is simple if this proceedure is adopted. A plot of (T_{max}) measured vs. (T_{max}) calculated with a worn track of maximum T's at any instant from any experiment, would do the job. A satisfactory model would have all calculated temperatures greater than all observed. Any experiment could be terminated when the rods were in jeopardy. Any experiment could be plotted.

I think it is a gross mis-appropriation of resources to use LOFT for small break testing. LOFT is expensive to run, hard to alter, impossible to allow to dryout and altogether inappropriate for small break testing. I suggest the facility be dedicated to operational transient testing, transients where CHF and voiding might occur. LOFT's unique capability in being able to provide real coupling between thermal-hydraulics and nutronics should be used. It should not be used for small breaks.

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The TRAC code assessment activities at BNL, LASL and INEL are exceedingly valuable. I would certainly like to see them continue. I would really like to see the customers speak up. There is a recent copy of a thesis by Der-Yu Hsia that I sent to YY that shows exactly the same difficulties in calculating the plenum flows that BNL found. We should be able to fix that in the next year. Professor M. Kazimi is working on it here.

I'm very favorably impressed with the RELAP-5 code. I believe it should replace the fast running TRAC with TRAC used for 2 and 3D problems for which it is best adopted. Perhaps NRC should pick up the cost of finishing RELAPS-5. I suspect that it is easier to build speed into a code than it is to add it later. RELAP-5 is fast.

I enjoyed the meeting very much and am impressed with the progress made since last time.

Sincerely,

Peter Griffith
Professor Mechanical Engineering

PG/jn

PROPOSED METHOD OF ANALYZING SMALL BREAKS

Peter Griffith
June 1980

Introduction - Small breaks are different in kind from large breaks because they run much longer and the larger number of stray variables that can affect the results. I can aim an arrow at a one foot diameter target 50 ft away and usually hit it. It is practically impossible for me to build a windup toy that will stop in a one foot diameter circle that is 50 ft. away on the floor. The inertia of the arrow and the initial velocity govern its motion. Drag scarcely matters. A wind-up toy moves much more slowly, however, and accumulated errors due to seams in the carpet and chair legs govern its motion. The wind-up toy is like a small break. How then should we handle small breaks. I'd like to propose a method.

The Proposal - Let us define the state of the system in terms of (in order of decreasing importance) the following variables:

1) System void fraction

2) System pressure

3) % of core power

Let's calculate a map, much like the one enclosed for all conditions. Void fraction doesn't completely define the system, the void can be distributed in various ways. Assume it is distributed in the worst possible way for these calculations.

Non-condensibles would be put into the system if the pressure is below that where the accumulators would have discharged.

A single pretest prediction, consisting of a book of maps of this kind, would be made for a single loop. No matter what happened in any experiment a comparison of pre-test prediction to experiment could be made. Perhaps this map could show maximum core temperature as a series of lines in the dryout region. If this proceedure is chosen, then a plot for each experiment could be made perhaps, a plot of (T_{max}) predicted vs. (T_{max}) observed for every state that the reactor passed through. The comparison would show a worm track of states to one side (hopefully) of the 45° line on the $(T_{max})_p$ vs. $(T_{max})_o$ plot. Look what this does for you on small breaks.

1) Unforseen events are unlikely to cause an unsuccessful test. A large pipe LOCA might during the test or a general instrument failure could, but little else.

2) Details of system configuration don't matter.

3) Control system set points, or mal-functions don't matter.

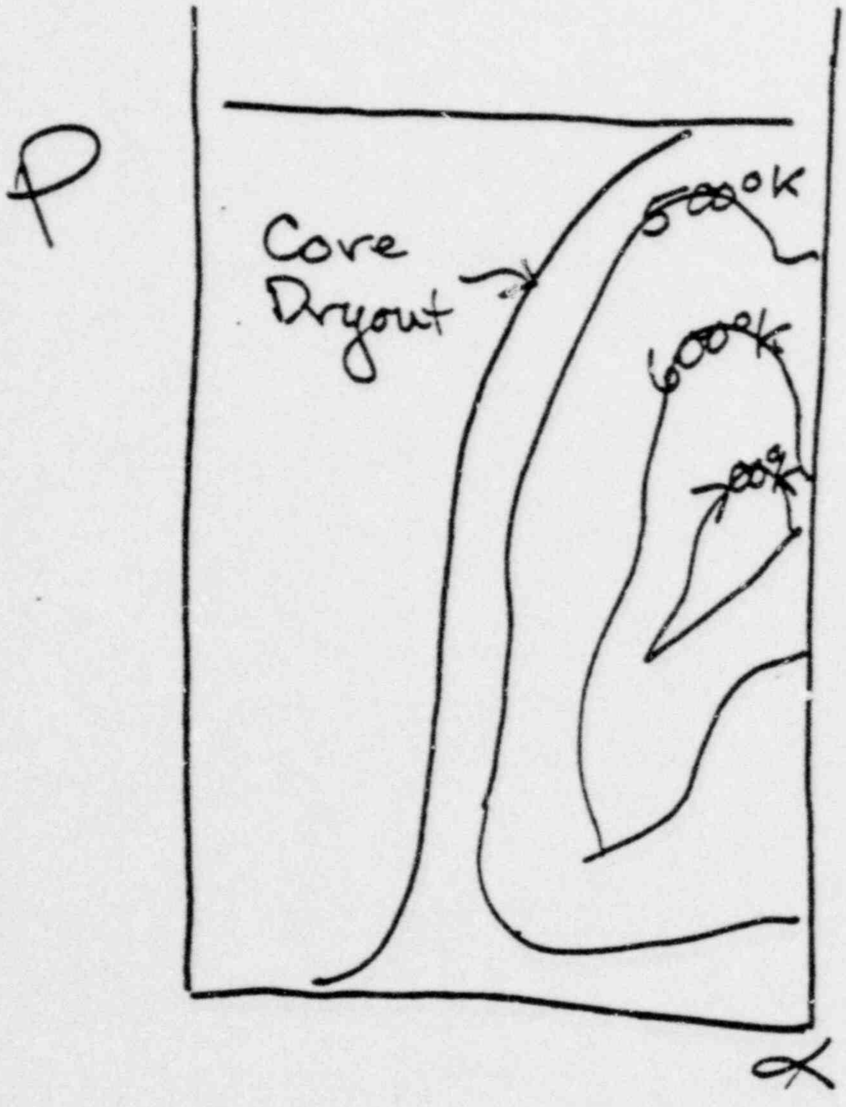
4) Break flow doesn't matter.

Break location, size, shape doesn't matter. Safety would be insured by showing that the control system, operator and ECC system always respond appropriately so that the reactor core is never in jeopardy.

Work will need to be done to explore various ambiquous situations as a result of instrument errors, failures in ECC systems and control system malfunctions. Wash 1400 could be used to deploy these research resources most effectively.

I think this method of handling small breaks is do-able, convincing and appropriate. It raises no extraneous research issues (like break flow) knowledge of which will do nothing to improve the safety of reactors but focuses on detecting the state of the system and taking appropriate corrective action.

Zion Plant



q = 1% rated power

Pumps off