CT-1344

FRANKLIN RESEARCH CENTER
A Division of the Franklin Institute

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Professor W. Kerr
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Re: ACRS, Class 9 Subcommittee Meeting
May 21-22, 1981, Washington, D.C.

Dear Professor Kerr:

The main subject of this meeting was discussion of status and use of MARCH computer code.

NRC Staff stated at the outset of the meeting that MARCH by itself will not be used as a tool to make licensing decisions - independent keparameter assessment will be done prior to any rulemaking. What does independent means was not quite clarified during the two day meeting, rather it was clear that MARCH "is the only game in town" as of now, German Code KESS is coming but not in any better shape than MARCH, except maybe for core meltdown and slumping model. Core meltdown is difficult to model, sequence is variable and outcome depends on too many things, no experiments likely to validate any of this. However, MARCH was used for analysis of H_2 issue for NTOP for Sequoyah, Pilgrim II.

How well one must know various parameters and how well is this matched by MARCH predictions was the subject of discussion at various points during the meeting. It appears clear that the initial peak pressure in the containment is predicted quite accurately (simple energy balance, can be obtained by hand calculation). Containment failure time prediction, for example, greatly depends on the accuracy of the structural containment capability prediction as well as the predictions of the MARCH code. If containment failure time is of order of eight hundred (800) minutes (as calculated for Indian Point 2) then the accuracy (on time) does not have to be very great, presumable there will be ample time for minitigation.

BNL discussed its use of MARCH in connec ion with the licensing support activity. Shortcomings of MARCH were identified in several areas. In some cases better physical models could be defined in other cases no better models exist. Buring BNL review MARCH 1.1 had been corrected and modified to produce an updated version of BNL inhouse MARCH. As one of the more significant future updates, INTER replacement with CORCON was identified. The following are identified as significant

additional shortcomings: lack of rational MARCH time step management (needed to demonstrate convergence and accuracy of the solution, BNL has not as yet completed numerical algorithm stability analysis); lack of iteration within a MARCH time step to account for nonlinearities (some not well defined iteration or time step change is presumably done in MARCH): "mixing" conversion of multi-volume core model into a single volume model for MARCH calculation (it appears that temperature averaging rather than enthalpy summation is done); lack of energy and mass conservation (in some phases of analysis); core heat transfer shut-off in HOTOROP, single phase break flow; no capability to model recovery after core slumps; H_2 source term limited to Zr only (expected 2000 lbs of H_2 from Zr and about 2000 lbs from corium-concrete interation); CO evolution modeled but not included in combustion.

It appears that combustion phenomena are the least understood because of lack of prototypical data (large scale tests have been conducted in non-nuclear areas such as those by the Coast Guard, for example). For this reason MARCH is suitable for scoping analysis but not suitable for complex combustion modeling.

Sandia Labs are involved in interim assessment of MARCH (independent of licensing exercises). Their preliminary findings are (work started January 21, 1981) that MARCH is useful and that it aims at the right level of computational detail. Some one hundred (100) different limitations have been identified. Sandia had the benefit of BNL findings, hence many items are the same as those of BNL. Apparently substantial effort is put on by Sandia (15 people available to MARCH effort).

Westinghouse finds MARCH Code good for general trends and conclusions but not specific enough for hard values for design. Westinghouse also never uses containment portion of the code (MACE). In general W feels that it takes altogether too much time (1/2 year) to get familiar with the code to use it - a MARCH is not a friendly code to the user.

EPRI has a twelve (12) month program to study MARCH on four (4) Nuclear Power Plants.

NSAC feels that MARCH results are repeatedly reported without discussion of inputs and options used. This may mislead the uniformed audience to believe that results produced by MARCH represent the real response of a plant.

The sum total impression is that MARCH indeed is "the only game in town" and that there exists a real need to have something like it. It is not suited for degraded core analysis (best estimate mode) but it can explore

the trends of consequences of postulated scenarios. NRC is spending significant amount of effort at BNL and Sandia, but not at the BMI (where MARCH was developed for probably a fraction of cost spent for review).

There appears to be a reaction by the industry and the NRC to jump on the bandwagon to improve MARCH, an activity possibly derived from the popularity of MARCH associated with the real need for a code like MARCH. This is fine, but may not be sufficient. MARCH is only one link in the chain of codes needed for offsite consequence calculation. If a general plan for such chain of codes exists, it was not identified at this meeting. Assuming that someone has such a plan, tune-up of individual codes has to be done in conjunction with the overall accuracy goals in the offsite consequence prediction. Bands of uncertainty on final result and the effect of each of the codes on these bands must be identified. MARCH users appear to be confused when asked about the error bands on MARCH results.

CORRAL-2 (computes set of radionuclides released from core to primary system, uses MARCH thermalhydraulic output) is being replaced by a new code (BMI). A number of other codes were briefly mentioned (RELAP, TRAC, SCADPIP), PBF, TRAP, CONTAIN), but their precise role in the total chain of codes for analysis of offsite consequences was not identified.

Very truly yours,

Zenons Zudans
Senior Vice President

cc: G. Quittschreiber
ACRS