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February 21, 1984

Mr. Mel Silberberg
Office of Nuclear Regulatory Research
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Comments relative to Peer Review Meeting
January 26-27, 1984

Dear Mr. Silberberg:

The discussions at the subject meeting and the subsequent NRC/IDCOR meeting have brought out the potential importance of fission product heating of plant components as the fission products are transported through the reactor systems. Except for the core and related heating, the current analysis methods do not consider the fission product heating of structures and the re-evolution of deposited fission products. This is an important point that needs to be addressed in light of the high retention of fission products being calculated for some of the accident sequences.

Natural circulation in PWR intact loops is not presently being considered. For those accidents where the piping and steam generators are heat sinks, there could be significant steam flow along paths not now being considered for fission product deposition.

In addition to the comments that I made verbally at the meeting, I have enclosed additional comments on the Draft Report ORNL TM-8842 concerning the status of validation of computer codes being used for the source term calculations.

Please call if you have any questions.

Sincerely,

D. S. Rowe

Enclosure

DSR:le

Comments by D. S. Rowe
ORNL TM-8842 (Draft)

I. FORWARD

Pg viii

The discussion on the last half of this page is the essence of validation and needs to be said more directly. Each major point should be presented with more emphasis. The discussion on the preceding pages is philosophy that obscures the meaning of the document and should be reduced substantially. The document should highlight each of the analysis elements such as:

The physical processes being considered
Mathematical modeling of the physics
Supporting data for the physics
Numerical solution
Coding QA
Verification of Computer solutions
Comparison to known results
Comparison to experimental data
Sensitivity to inputs or unknowns

Pg 5

The claim is made regarding a broad base of experimental support (with exceptions). The majority of the discussion that follows focuses on the exceptions and does not support the positive features of the modeling. This leaves the reader uneasy about the approach. Additional focus on what is done could provide a more positive statement.

Pg 5-18

The negative aspects of this discussion needs to be weighed against the positive features.

Pg 18

In summary then, the .... An emphasis heading is needed here. The positive statements don't follow from the previous discussion.

Pg 19

Containment failure is mentioned but is not discussed in document. This is being addressed separately -- need reference.

MARCH 2

This is the first summary description of MARCH for the peer review and is welcome.

Pg 43

In reference to an "essentially correct" energy balance at the bottom of the page; experimental data does not necessarily verify the correctness of the energy balance. This can be done by using consistency checks in the code.

Pg 74

What is the basis for Eq(37)?

Pg 81

Reference to "energy equivalent" temperature is more properly enthalpy. In general, if the energy balances are based on enthalpy, they can more easily and consistently represent phase change.

Pg 84

A time dependent problem is being considered. Where is the time derivative for Eq(67)? Why not solve a 2X2 system for Tr and Tg (Eq(55) and (67)) to eliminate the "difference in energy" (energy error) problem?

Pg 85

Does Eq(72) and related approach satisfy an energy balance — not clear that it does.

Pg 86

Is Eq(76) a time dependent equation?

Pg 103

The oscillation of primary-to-secondary temperature difference is probably numerical and could be eliminated by using a higher level of implicitness and solving the equations for temperature simultaneously.

Pg 104

The discussion leading to Eq(114) is not clear.

Pg 106

Eq(119) is not dimensionally correct. Misplaced Δt?

Pg 121

The basis of Eq(160) is not clear.

Pg 123

The use of flow weighted density is not standard — volume weighted averages are normally used for density.

Pg 143

The limitations of series paths is a major restriction to MARCH. Parallel paths would allow natural circulation transport that could impact the distribution and retention of fission products.

Pg 183-185

The issue of fission product transport and related heat source transport can be important to the source term analysis. Dealing with the consequences of decay heating of the core and subsequent heating of plant components is a major issue of the source term analysis. Transport of fission products is also a transport of the heat sources and that topic deserves more attention.

General

The modeling approach in MARCH is rather ad hoc and does not reflect the consistency of a more formalized approach. This makes review and checking difficult.

The mix of computer program notation and mathematical notation detracts from the writeup and is inconsistent with other sections of the report.

There are many assumptions made without supporting statements.

The control volume representation need clarification — fluid volumes, solid volumes and the transport processes between them.

CORCON

Pg 219-221

The concept of layers in the presence of intense circulation and two-phase flow seems to be contradictory. Further discussion of this is needed in relation to the data discussed on Pg 222. What is the impact of fluids with large density ratios?

General

The format and approach of the section is good and makes a good model for other sections of the document.

MERGE

Pg 335

There is some overlap of heat transfer calculation between MERGE and MARCH. Are they consistent? How are they reconciled?

Pg 337

The use of a single structure temperature could be overly simplistic. Something should be said about the average versus surface temperature for the analysis. The heat transfer correction factor can not adequately account for this temperature difference.

General

The control volume representation needs to be more clearly defined -- fluid volumes, structure volumes and the transport processes between them.

The writeup my be overly abbreviated in some places.

TRAP-MELT

III-C.2

I would concur with the conclusions of this section. The series representation of the flow path and the inability to consider natural circulation through PWR flow loops limit the applicability of the model.

III-D.1

M = CQ is not the incompressible continuity equation -- it is a definition for mass flow rate. The continuity equation is a statement of the net flow into and out of the control volume and the rate of accumulation of mass in the volume.

III-D.2

There are two natural convection considerations. The one stated attempts to account for more local natural convection by using a heat transfer coefficient at a wall. The other that is not included is the macro natural circulation. It is excluded by the uni-directional limitation of the model.

III-D.3

Condensation in the steam generators is not mentioned. Is this a major affect that is not included? Steam generators could be an important sink for steam flow where they are not boiled dry on the secondary side. This could create flow paths for fission product transport that are not presently being considered. Noncondensibles can also be important.

III-D.4

The equation for M/t does not have a convective transport term. I would expect the equation to be of the form

$$\frac{\partial M}{\partial t} + V \frac{\partial M}{\partial z} = -V_d \frac{A}{V_w} M$$

for one-dimensional flow. The $V \partial M/\partial z$ accounts for the transport by the flow. If this term is missing, it is a fundamental omission that should be corrected.

III-D.5

Agglomeration in wet or humid environments needs to be discussed.

III-E.1

I agree that the deposited fission products could by important heat sources affecting structural temperatures and re-evolution of fission products.

III-E.2

Recirculation in PWR intact loops could also be an important affect.