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

Subject: Comments Relative to NRC/IDCOR Meeting
February 7-8, 1984

Dear Mr. Silberberg:

The following comments are offered as a result of the subject meeting and as it could relate to the NRC source term evaluation -- BMI-2104:

- 1) The general structure and approach of the MAAP code appears to have a more unified and consistent approach than is contained in MARCH. This is probably due to the time frame of its development which postdates the development of MARCH. Nothing can be said at this point about its predictive ability as compared to MARCH.
- 2) The analytical methods of the IDCOR study can consider control volume arrangements that represent flow loops in the primary system and containment. This is contrasted to the limitation of series connected control volumes in the analytical methods being used in the BMI study. The IDCOR treatment of loops can allow consideration of natural circulation and condensation flows in FWR intact loops and in the containment. This could provide a different distribution and retention of fission products in the primary system and in the containment.
- 3) While the IDCOR study has not yet performed an analysis with coupled fission product and structure heating (except for core and vessel heatup), their thinking is certainly in that direction. The BMI study has also not considered this phenomena but it has been discussed.

The plant structure can initially provide heat sinks that promote deposition of fission products. As the

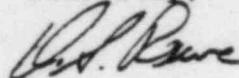
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fission products accumulate, the structure will be heated and could eventually reach a surface temperature where fission products could re-evolve from the surface and be transported farther downstream. This is really a process of transporting both the fission products and their heat sources. Based on the considerable discussion of this topic at the meeting, it is worthwhile considering it in more detail to define its importance to the results of the BMI study.

- 4) The re-evolution of fission products has the further affect of changing the space and time distribution of fission products and their form (volatile, particle, etc.). This could be especially important relative to the time of containment failure.
- 5) The use of a "log-normal" model for particle size distribution in the IDCOR study is a simplification from the discrete particle size model used in the BMI study and that could lead to different results. This was well discussed at the meeting and noted as a difference. The discrete size model in the BMI study should be more accurate.

Please call if you have any questions.

Sincerely,



D. S. Rowe

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 may 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

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

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 be 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.