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February 6, 1984

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COMMENTS ON BMI-2104, VOLUMES I THROUGH VI, RADIONUCLIDE RELEASE UNDER SPECIFIC LWR ACCIDENT CONDITIONS (DRAFTS FOR PEER REVIEW)

At your request I have reviewed the six draft volumes of BMI-2104 and have attended four of the five peer review meetings. I have also reviewed the supporting document on the status of computer code validation, ORNL/TM-8842. Many of my comments were expressed orally during the review sessions, but I am attaching a list of comments for your consideration.

I wish to thank NRC for the opportunity of serving as a peer reviewer of the source term reassessment program. I appreciate your position of actively seeking comments and your demonstrated willingness to incorporate them when possible. The NRC contractors (BCL, ORNL, SNL, PNL) are to be commended for their good work.

If you have questions concerning my comments, please call me on FTS 440-1584.

RK Hilliard

R. K. Hilliard
Fellow Engineer

dht

Attachment: Peer Review Comments

DOE/RL-AMAR - RJ Myjak (w/o attachment)
KR Absher

DOE/HQ-BTP - Sr. Division Director, Safety and Physics
Asst. Director, Safety and Physics

USNRC - ~~M Silberberg~~

FRS/TMC-ANL - DR Ferguson
L Baker, Jr.

ATTACHMENT TO 8450458

COMMENTS ON BMI-2104, DRAFT VOLUMES I THROUGH VI, "RADIONUCLIDE RELEASE UNDER SPECIFIC LWR ACCIDENT CONDITIONS"

R. K. Hilliard

February 2, 1984

1. The methodology appears logical, although interfacing 8 different computer codes seems cumbersome and increases the chance of input errors.

2. The present approach uses newly developed computer codes that are by and large unvalidated. The ORNL review of the status of validation is very helpful in describing the code bases and state of validation. However, until adequate validation has been achieved, the calculated source terms should be considered tentative.

3. The documents have very little interpretation of the data, comparison between volumes, or other insights obtained by the authors during the performance of the work. An additional volume providing overall conclusions would be valuable.

4. The QUEST uncertainty analysis appears to be little more than a sensitivity study. Though interesting, its value is limited unless the true uncertainty on the end product can be quantified. The oral presentation, although given by excellent speakers, was much too rapid and the material too new for me to evaluate it adequataly.

5. Only Volume I gives the release to environs of FP species other than I, Cs and Te. A similar treatment for Ba-Sr, Ru and La in the other volumes would be useful.

6. More comparisons of calculated source terms with WASH-1400 would be informative.

7. An important removal mechanism, impaction, has been omitted from the TRAP-MELT code. This mechanism may be dominant for some conditions (flow normal to surfaces, bends in pipe, etc).

8. The effect of FP decay heat should be accounted for, not only for the effect on thermal hydraulic conditions, but for possible melting of steel pipe or components and revolatilization of deposited material. This topic was discussed at length during the last peer review meeting, and there was general agreement that it could have an important effect on the release to the environs. It should be studied carefully.

9. Properties of the gas mixture (H_2, steam) should be used, rather than those of pure steam. A good compilation of many properties of mixtures is given in ANL/ENG/TM-01.

10. The presence of liquid water in the flow path is likely in several of the sequences analyzed as dry systems (TMLB', V). A more realistic analysis should be made for these cases.

11. Iodine is assumed to exist only as CsI. There appear to be suitable conditions for some formation of I_2 and organic forms. High temperature exposure in the presence of oxygen and reaction with boric acid are two known processes for I_2 formation. The effect should be evaluated.

12. Hydrogen may burn as a standing flame at the point of release to the containment atmosphere. The effect on aerosol properties and behavior should be evaluated.

13. The deposition in containment leakage paths has been ignored. Although difficult to quantify, some assessment of this potentially important effect should be made.

14. The effect of ionizing radiation on FP behavior has been completely ignored in the codes and in the ORNL assessment of code validation status. The effect may be negligible, but should be addressed in the ORNL/TM-8842 document.

15. For the SURRY V-Sequence, it appears that the break point in the low pressure interface piping would be under water at the end of the blowdown. This would have a major effect on retention of radionuclides. When the primary reactor vessel melts through, water would be sucked back through the piping and PRV to equalize pressure in the initially sub-atmospheric containment building. What is the effect on release of FPs to the environs?

16. Based on my experience, I believe that the initial particle size used in TRAP-MELT is too small. A mechanistic code, such as the ANL RAFT code, may be useful in predicting initial particle sizes.

17. Uniform chemical composition of all aerosol particles, independent of size, is assumed in both TRAP-MELT and NAUA codes. This may not be correct and the effect of nonuniform agglomeration should be evaluated.

18. The assumption is made in both TRAP-MELT and NAUA that settling is due to the difference between vertical convective flow and Stokes settling velocities. This is not a valid assumption for flow in boundary layers near horizontal surfaces, and the uncorrected Stokes velocity should be used (with Cunningham and Klyachko corrections, as appropriate).

19. Resuspension of deposited aerosol in the RCS and containment has been ignored. The importance of this phenomenon should be assessed.

20. In Volume V, p. 6-68, Table 6.2, TMLB-δ, should probably be changed to TMLB-ε.

21. All cases analyzed assumed no operator intervention in the course of the accident. How is operator action addressed?

22. A good editing effort would greatly help the reader in understanding the contents of the six volumes.

23. Good progress has been made during the past few years in assessing the source terms. Much more work remains before confidence can be claimed for the accuracy of the predicted magnitudes.