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February 10, 1983

Mr. M. W. Jankowski
Fuel Behavior Branch
Division of Accident Evaluation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Jankowski:

Accompanying this letter are my comments on NUREG-0956.

I am not sure about which office is responsible for the financial details of my travel expenses and consulting fees. I have provided Neill Thomasson in the Office of Policy Evaluation with the necessary information, and trust that sooner or later I will receive a check from his office or yours.

I appreciate this opportunity to work with the N.R.C.

Yours truly,

Jim Kelly

J. L. Kelly, Professor
Dept. of Nuclear Engineering
and Engineering Physics

JLK:ph

Encl.



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COMMENTS ON REVIEW OF NUREG-0956

James L. Kelly, University of Virginia

A two-day peer review meeting was held at U.S.N.R.C. Headquarters on January 25 - 26, 1983. The subject was the draft edition of NUREG-0956 (Vol. I), "Radionuclide Release Under Specific LWR Accident Conditions (Volume I, A PWR Analysis)." This report (NUREG-0956) represents a major effort to address the shortcomings of NUREG-0772, "Technical Bases for Estimating Fission Product Behavior During LWR Accidents" (June, 1981). My comments on NUREG-0956 are presented below.

I. Comments about code work

A major criticism of NUREG-0772 was that the codes that were used (MARCH, TRAP-MELT, HAARM-3, CORRAL-2, QUICK, NAUA) were neither comprehensive nor sufficiently mechanistic. Each exhibited serious deficiencies with respect to the ability to analyze the conditions along the fission product transport path.

NUREG-0956 indicates that considerable progress has been made in the past two years toward developing better codes, e.g., MARCH 1.1, MERGE, CORSOR, CORCON, TRAP-MELT, CORRAL-2 (modified) and NAUA-4. A number of deficiencies evident in the code work of NUREG-0772 have been eliminated. However, even more progress must be made before the system of codes may be considered to be sufficiently comprehensive and mechanistic. A few examples of points where improvements in the codes are needed are:

(1) a more realistic fuel melting model,

(2) a more realistic treatment of core-slump,

(3) a mechanistic code to replace CORSOR,

(4) an accounting for control rod silver as an aerosol source,

(5) a more realistic pathway for core-concrete aerosols,

(6) an accounting for decay heat from deposited nuclides,

(7) a more realistic treatment of flow in the upper plenum,

(8) an accounting for aerosols of uranium and plutonium,

(9) a mechanistic model for containment failure,

(10) an accounting for retention in the auxiliary building for sequence V,

(11) an accounting for chemical reactions among volatile and aerosol species,

(12) an accounting for attenuation along containment leak path, and

(13) an accounting for water condensation on aerosols.

II. Comments about experimental data

In the absence of an adequate experimental data base, computational results, such as presented in Chapter 7 of NUREG-0956, are of questionable value. Unfortunately, NUREG-0956 fails to discuss the status of the data base, leaving the reader to infer that no significant advances in the acquisition of experimental data have been made since the writing of NUREG-0772. If that inference represents the true status of the data base, a serious deficiency still exists in the ability to analyze radionuclide releases. (NUREG-0772 presents an extensive, but incomplete, list of data base limitations in Section 1.4.)

III. Conclusions

(1) NUREG-0956 lacks balance in that it discusses recent advances in code work but totally neglects the important subject of

experimental data. An up-to-date summary of the data base should be included in NUREG-0956, or should be published as a separate report.

(2) It is emphasized in NUREG-0956 that the nature (i.e., timing, size, and location) of containment failure represents perhaps the single most important parameter with respect to fission product release to the environment. However, this event (containment failure) is treated in a completely arbitrary and non-mechanistic fashion. A large effort, both in the experimental and code work areas, must be directed at developing a credible method for analyzing containment failure modes.

(3) There is a huge amount of experimentation remaining to be done to generate an adequate data base.

(4) The code work in NUREG-0956 is advanced relative to NUREG-0772, but is still deficient in a number of important areas. Some of these deficiencies cannot be properly addressed until the requisite experimental data are available. Development work should continue with the codes.

(5) The NRC should exercise caution in publishing NUREG-0956. The computational results presented in Chapter 7 have been generated by using an inadequate data base as input into a system of non-comprehensive, partly non-mechanistic codes. These results, therefore, should be regarded with a high degree of skepticism. If published, NUREG-0956 should be replete with qualifying statements in order to reduce the likelihood of the results being misinterpreted and misused.