NUREG-0956

Sandia National Laboratories
Albuquerque, New Mexico 87185

February 1, 1985

Mr. O. E. Bassett, Director
Division of Accident Evaluation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Bassett:

Submitted herewith is a summary report of technical & programmatic activities and results for FY84. The report condenses details described in bi-monthly progress reports submitted throughout the year into summaries that should be of interest to those dealing with current severe accident issues. It should be noted that some observations are, of course, preliminary and subject to revision as more work is completed. The report is prefaced with a list of highlights, each cross referenced to more detailed discussion in the main text.

Our major FY84 focus has been on matters important to the definition of severe accident radiological source terms. Specifically, the QUEST study provided insights into the nature and magnitude of source term uncertainties and defined the important severe accident phenomena whose uncertainties dominate source term uncertainties. Other programs provided data and computational support to the NRC source term reevaluation effort (BMI 2104 and CLWG). Of most importance were chemistry data describing the interaction of the important fission product species with structural materials which were used in the TRAP-MELT code calculation of fission product transport and retention in the RCS. Also, detailed mechanistic computations of ex-vessel release for each sequence analyzed in BMI 2104, using our newly developed VANESA model, were provided to BCL.

An important perspective from QUEST was that a necessary condition for technically defending lower severe accident source terms in safety deliberations requires that early containment failure probabilities be shown to be low. To this end a concentrated effort was made to develop models necessary to quantify containment threats from hydrogen burning and detonations, from direct containment heating due to melt ejected from the reactor vessel in high pressure meltdown scenarios and from in-vessel steam explosions. This model development was accompanied by experimental programs to define and quantify the important phenomena. Considerable progress has been made in quantifying the first two phenomena this year and the focus on dealing with the latter has been considerably sharpened.

This has been a productive year for the program developing the mechanistic in-vessel melt progression code MELPROG with completion and demonstration of the first useful code version. Code development has emphasized the phenomena shown by QUEST to be important to accurately describe fission product release and transport. The HECTR hydrogen containment response code and the advanced core melt concrete interaction code CORCON MOD 2 were also completed and released to the safety analysis community.

Finally, nine ACRR tests were conducted in FY84: (1) DF-1 LWR fuel melt progression, (2) DCC-2 LWR degraded core coolability, (3) STAR 1 and 2 fuel and clad motion, (4) TRAN B-3, B-4, B-5 molten fuel hydrodynamics, (5) D-10 bottom cooled LMFBR debris coolability, and (6) DC-2 UO_2 melt progression. All tests were successfully completed and provided considerable data which are currently being used to develop and verify accident analysis code models.

Questions on topics discussed in the report should be directed to me or to the individual authors designated in the text.

Very truly yours,

J. V. Walker, Manager
Reactor Safety Research
Department 6420

Enc: As stated

R. W. Barber, USDOE
R. B. Minogue, NRC/RES
D. F. Ross, NRC/RES
O. E. Bassett, NRC/RES
R. M. Bernero, NRC/NRR
C. N. Kelber, NRC/RES
W. M. Morrison, NRC/RES
G. P. Marino, NRC/RES
M. Silberberg, NRC/RES
R. T. Curtis, NRC/RES
R. W. Wright, NRC/RES
T. J. Walker, NRC/RES
P. M. Wood, NRC/RES
S. B. Burson, NRC/RES
J. T. Han, NRC/RES
L. K. Chan, NRC/RES
J. T. Larkins, NRC/RES
T. M. Lee, NRC/RES
C. L. Allen, NRC/NRR
F. H. Rowsome, NRC/NRR
J. F. Meyer, NRC/OCM
J. Austin, NRC/OCM
R. O. Meyer, NRC/ASTPO
J. A. Mitchell, NRC/ASTPO
C. Ryder, NRC/ASTPO
W. C. Lyon, NRC/NRR
L. G. Hulman, NRC/NRR
R. Van Houten, NRC/RES
P. Worthington, NRC/RES
C. G. Tinkler, NRC/RES
C. W. Nilsen, NRC/RES
T. P. Speis, NRC/NRR
J. E. Rosenthal, NRC/NRR
G. R. Burdick, NRC/RES
J. A. Martin, Jr., NRC/RES
P. M. Williams, NRC/NRR
J. Reed, NRC/NRR
J. L. Telford, NRC/RES
M. A. Cunningham, NRC/RES
F. P. Gillespie, NRC/RES
V. Benaroya, NRC/CHEB
W. R. Butler, NRC/CSB
R. L. Palla, NRC/CSB
K. I. Parczewski, NRC/CHEB
J. Austin, NRC/OCM
G. Quittschreiber, NRC/ACRS
R. P. Savio, NRC/ACRS

Z. R. Rosztoczy, NRC/NRR
L. C. Shao, NRC/D/DET
K. G. Steyer, NRC/CEBR
T. M. Su, NRC/GIB
R. H. Vollmer, NRC/D/DE
P. Baybutt, BCL
R. Denning, BCL
W. Kato, BNL
M. Stevenson, LANL
T. Kress, ORNL
M. L. Corradini, University of Wisconsin
J. H. S. Lee, McGill University
T. G. Theofanous, Purdue University
R. Strehlow, University of Illinois
R. C. Vogel, EPRI
L. Baker, Jr., ANL
R. Anderson, ANL
E. A. Warman, Stone & Webster
M. W. Fontana, TEC
M. W. Jankowski, IAEA