

July 8, 2003

MEMORANDUM TO: Ledyard (Tad) Marsh, Director
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

FROM: Michael E. Mayfield, Director */RA/*
Division of Engineering Technology
Office of Nuclear Regulatory Research

SUBJECT: TRANSMITTAL OF NUREG/CR-6809, "POSTTEST ANALYSIS
OF THE NUPEC/NRC 1:4 SCALE PRESTRESSED
CONTAINMENT VESSEL MODEL"

The Division of Engineering Technology is forwarding the subject NUREG/CR report for information and use in support of resolution of containment issues. This report was prepared by ANATECH Corporation, under a subcontract from Sandia National Laboratories.

This report was provided to aid the NRC staff in its evaluation of estimates of containment capacity provided by licensees or applicants of new plants. Containment buildings for the current generation of light water reactors were designed to withstand a variety of loading conditions including the effects of earthquakes and postulated accidents. Original designs were performed in accordance with the requirements of the ASME Boiler & Pressure Vessel Code leading to very high confidence that the vessels can sustain design basis conditions. After the TMI accident, the performance of containment systems under more severe accident conditions became a matter of continuing interest and concern and a research program to develop an understanding of dominant failure modes for the different types of containment began. Tests to failure of models of a free standing steel containment and a reinforced concrete containment were performed under NRC sponsorship in 1985 and 1987, respectively. Finally, tests to failure of models of a steel containment structure with a shield wall and a prestressed concrete containment were performed jointly with NUPEC (of Japan) in 1995 and 2000, respectively. The last test is the subject of this memorandum.

Analytical studies were performed by ANATECH Corporation, under subcontract to SNL, in connection with the test of a prestressed concrete containment vessel model. The first phase of calculations consisted of preliminary analyses to determine what finite element models would be necessary for pretest predictions and the second phase consisted of performing the pretest prediction to be included in a round robin prediction by seventeen organizations. The final phase, reported here, involved posttest analyses performed to provide information that could be used by the NRC staff in evaluating predictions of containment response, up to the point of failure, by licensees or applicants. Data to validate such predictions were not available before as previous work did not encompass the condition when prestressed concrete containment vessel experiences severe accident conditions to the point of failure.

L. Marsh

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The work was successful in meeting its objectives of: (1) providing insights to improve the analytical methods for predicting the structural response and failure modes of a prestressed concrete containment, and (2) evaluating by analysis any phenomenon or failure mode observed during the test that had not been explicitly predicted by pre-test analysis. This work contributes to the NRC's performance goals of maintaining safety and enhancing public confidence.

Attachment: As stated

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