

June 6, 2001

MEMORANDUM TO: Jack R. Strosnider, Jr., Director
Division of Engineering
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-6706, "CAPACITY OF STEEL AND
CONCRETE CONTAINMENT VESSELS WITH CORROSION DAMAGE"

NUREG/CR-6706 is the Sandia National Laboratory's (SNL) final report for job code J6042, "Capacity of Degraded Containments." This work was conducted to meet, in part, the Office of Nuclear Reactor Regulation (NRR) user need memorandum that was dated May 8, 1996, from W. T. Russell to D. Morrison, in which NRR requested the Office of Nuclear Regulatory Research (RES) to perform degraded containment research. By memorandum dated July 2, 1996, from D. Morrison to W. T. Russell, RES proposed two programs for addressing the issue: (1) determining the "Capacity of Degraded Containments," and (2) "Inspection of Steel Containments and Liners."

NUREG/CR-6706 presents the results for the first program mentioned above, "Capacity of Degraded Containments." SNL used a finite element method to calculate the effects of corrosion on the capability of steel and concrete containments to withstand the loads associated with accident conditions. The pressure capacity was calculated for two typical steel containment vessels (PWR & BWR) and two typical concrete containment vessels (reinforced concrete PWR and prestressed concrete PWR) where the location of corrosion and the amount of corrosion was varied for each calculation. A "lower bound", "best estimate", and "upper bound" failure level was predicated for each calculation performed. RES believes the findings provided in NUREG/CR-6706 provides information to judge the adequacy of licensees' analyses and the resulting capacity margin of containments for given conditions of corrosion. Before publishing NUREG/CR-6706, a draft of the report was sent to NRR for review.

NRR comments on the draft NUREG/CR-6706 report were that more analysis should be performed for prestressed containments and that the effects of several types of containment degradation (liner corrosion, loss of prestress, and degraded bellows) should be integrated into one analysis. Attached is a copy of a Sandia letter report entitled "Capacity of Prestressed Concrete Containment Vessels with Prestressing Loss," which investigates the effects of partial and complete loss of prestressing tendons. The findings are that for a loss of coolant accident the partial loss of prestressing tendons does not significantly impact the ultimate load capacity of the containment while the complete loss of prestressing tendons has a more significant

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impact on the ultimate load carrying capacity of the containment. However, it should be noted that concrete cracking occurred at much lower load levels for partial and complete loss of prestressing tendons.

To address the NRR comment on assessing the effects of several types of containment degradation in one analysis, RES started a new research program this fiscal year, job code Y6164, "Structural Risk Informed Assessment of Containment Degradation," at SNL. The first task for Y6164 is to assemble an electronic database that contains information that would be useful to NRC staff especially those reviewing degraded containment analysis. As significant progress is made in our new research effort, we will inform you and invite your review and comment on resulting products.

If you have any questions on the attached reports, please call Sher Bahadur (415-6010) of my staff.

Attachments: As stated

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