

April 3, 2001

MEMORANDUM TO: William H. Bateman, Chief
Materials and Chemical Engineering Branch
Division of Engineering,
Office of Nuclear Reactor Regulation

FROM: Nilesh C. Chokshi, Chief **/RA/ by Nilesh C. Chokshi**
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SUBJECT: TRANSMITTAL OF NUREG/CR-6699, "A REVIEW OF LARGE-SCALE
FRACTURE EXPERIMENTS RELEVANT TO PRESSURE VESSEL
INTEGRITY UNDER PRESSURIZED THERMAL SHOCK CONDITIONS"

The subject NUREG/CR was published by Oak Ridge National Laboratory in January 2001 under a RES research contract, "International Pressure Vessel Technology Cooperative Program" (JCN 6631).

This report provides an overview of 20 large-scale fracture experiments that have been conducted in the U.S. and several other countries during the past fifteen years to assess a range of factors affecting structural integrity of PWR pressure vessels under potential pressurized thermal shock (PTS) conditions. These tests involved cylindrical specimens with and without inner-surface cladding, model pressurized vessels, thick plates and beam specimens to study several factors that may synergistically influence the integrity of reactor pressure vessels (RPVs) under possible PTS conditions.

These tests have also involved pre-test and post-test analyses to predict and understand a number of the key parameters that may affect the structural integrity of RPVs under PTS conditions. Eight major factors that were highlighted most often in these tests were: (1) flaw characterization; (2) shallow-flaw constraint and multi-axial loading effects; (3) material properties' sensitivity; (4) fracture-mode conversion from cleavage crack initiation to ductile tearing and possible cleavage re-initiation; (5) residual stresses in welds; (6) cladding effects at the interface between clad and base-metal; (7) warm-prestressing effect on cleavage crack initiation; and (8) role of crack-arrest.

Some of these tests have served as benchmarking tools for comparing the analysis methodologies developed by various research organizations in U.S. and other countries through international cooperative projects, workshops and specialists meetings.

The NRC, the IAEA International Working Group on Life Management of Nuclear Power Plant (LMNPP) Management, and the Nuclear Energy Agency's (NEA) Committee on Safety of Nuclear Installations (CSNI) have served as the organizations to share information from most of these large-scale experiments.

The MEB/DET/RES project monitor for this work is Shah Malik, who can be reached on 415-6007, or by email: snm@nrc.gov for further information on this report.

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