U.S. DEPARTMENT OF ENERGY
NUCLEAR ENERGY RESEARCH INITIATIVE
ABSTRACT

PI: **T. Chu** **Proposal No.: 99-0018**

Institution: **Sandia National Laboratories**

Collaborators: **U.S. Nuclear Regulatory Commission, OECD/Nuclear Energy Agency**

Title: **Application of Innovative Experimental and Numerical Techniques for the Assessment of Reactor Pressure Vessel Structural Integrity**

The lower head of a reactor pressure vessel can be subject to significant thermal and pressure loads in a core meltdown accident. The objectives of the proposed investigation are to experimentally characterize the deformation and failure of the reactor vessel lower head, and to develop a robust analytical capability to predict lower head deformation and failure for conditions of partial depressurization and large across-the-vessel temperature differential (ΔT_w). There are no experimental data on validated models for conditions of large ΔT_w.

Five 1:5 scaled-experiments will be performed with a $\Delta T_w \cong 200K$ to examine the effects of heat flux distribution, pressure level, pressure transient, penetrations and wall ablation using test vessels made of SA533B1 reactor vessel steel. A constitutive model of SA533B1 will be developed based on material property testing data. A finite element model of RPV creep deformation and failure with robust treatment of stress redistribution effects will be developed and validated against the integral experiments.

The overall project is organized through OECD/NEA/CSNI with NERI program providing 25% of total funding. Altogether the work described here is approximately $2M with the NERI contribution being $500K over three years. This project supports national goals of increasing collaboration with international organizations.