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

PI: **Thurlow Caffey** **Proposal No.: 99-0308**

Institution: **Sandia National Laboratories**

Collaborators: **New Mexico State University, Electric Power Research Institute**

Title: **Continuous-Wave Radar to Detect Defects within Heat Exchanger & Steam Generator Tubes**

The major cause of failures in heat exchangers and steam generators in nuclear power plants is degradation of the tubes with in them. The principal cause of tube failure is the development of cracks that begin on the outer surface of the tube and propagate both inwards and laterally. The goal of this project is to demonstrate, with a fully developed operating prototype, a revolutionary technique for both defect detection and characterization using a continuous-wave radar device. The continuous-wave radar instrument consists of a magnetic dipole transverse to the tube axis (transmitter) and a small electric dipole on the tube axis (receiver). The concept for this instrument was previously demonstrated through numerical modeling, which showed that it should be possible to detect cracks with a scattering loss of up to ~40dB in thin-walled boiler tubes. The technique is 100% volumetric, and will find smaller defects, find them more rapidly, and find them less expensively than present methods. This tool will enable improved inspection quality, while reducing inspection costs. Consequently, the timing of repairs will be improved, there is potential for reducing plant down-time and the life of major capital equipment will be extended.