N3423. ADDRESSING THE PROBLEMS OF STRESS CORROSION CRACKING IN PWR CONTROL ROD DRIVE MECHANISM PENETRATIONS

The Mechanical Stress Improvement (MSIP), which works by removing tensile residual stress and generating compressive residual stresses at weldments, has been successfully applied to protect weldments against stress corrosion cracking in BWR plants worldwide.

MSIP is now being applied to addressing the problem of stress corrosion cracking in PWR vessel head Inconel-600 control rod drive mechanism (CRDM) penetrations. AEA Technology Engineering Services (AEAT ES) of Pittsburgh, PA, USA (formerly AEA O'Donnell) has developed a variant of MSIP involving axial contraction for application to the CRDM penetrations a PWR reactor vessel, with the aim of eliminating potential primary water stress corrosion cracking (PWSCC) in the penetration weldments.

A comprehensive elastic-plastic analysis developed to demonstrate the benefits of MSIP is shown as follows:

1) As-welded tensile stresses are reduced by axial contraction of the nozzle.
2) Better improvement of stress would be achieved if the penetration was contracted when the vessel head was subjected to internal pressure, or when there was a difference in average temperature of order of 150-200 F between the vessel head shell and the inconel.

For more information see M.L. Badlani et. al, Nuclear Engineering International, Vol. 42, No. 510, January 1997, pp. 34-35.