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## EFFECTS OF ZINC ADDITIONS ON THE CRACK GROWTH RATE OF SENSITIZED STAINLESS STEEL AND ALLOYS 600 AND 182 IN 288°C WATER

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**Objectives:** The goal of this study was to evaluate the effects of 5 to 10 ppb $Zn^{2+}$ addition on the stress corrosion crack growth rates of sensitized Alloy 600 using 25 mm compact type (CT) specimens, and sensitized type 304 stainless steel and Alloy 182 weld metal using double cantilever beam (DCB) specimens.

**Comments:** Zn additions of 5 to 10 ppb were consistently beneficial in reducing crack growth rates of sensitized Alloy 500, sensitized type 304 steel, and Alloy 182 weld metal in ~288°C water containing 0 or 200 ppb $O_2$ and 0 to 0.4 µM $H_2SO_4$. The reduction in crack growth rate from Zn addition ranged from about a factor of 5 for sensitized type 304 stainless steel or Alloy 182 weld metal in 282°C pure water at low corrosion potential, to about a factor of 2 for sensitized Alloy 600 in 288°C water containing 200 ppb $O_2$ and 0.3 µM (0.267 µS/cm) $H_2SO_4$. Approximately a factor of 2 was also observed in a four-inch diameter, weld sensitized type 304 stainless steel pipe.

**Remarks/Potential for dose limitation:** In the last several years, ZnO additions to BWR water have been studied, primarily because of their beneficial influence in reducing buildup of radioactive species such as Co-60 in the oxide film of structural components. Its success and lack of notable adverse side effects has resulted in its implementation in a few BWRs. However, no prior evaluation of Zn additions on crack growth has been performed.

**References:** Andresen, P.L., and Diaz, T.P., "Effects of Zinc Additions On the Crack Growth Rate of Sensitized Stainless Steel and Alloys 600 and 182 in 288°C Water," *Water Chemistry of Nuclear Reactor Systems 6*, Vol. 1, pp. 169-175, British Nuclear Energy Society, London, 1992.

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