

Hard Sludge Formation and Consolidation in Pressurized Water Reactor Steam Generators: An Experimental Study

Authors : R. Fernandez-Saavedra, M. B. Gomez-Mancebo, D. Gomez-Briceno

Abstract : The gradual corrosion of PWR (Pressurized Water Reactor) feedwater, condensate and drain systems results in the inevitable liberation of corrosion products, principally metallic oxides, to the secondary circuit. In addition, other contaminants and impurities are introduced into the makeup water, auxiliary feedwater and by condenser leaks. All these compounds circulating in the secondary flow can eventually be transported to steam generators and be transformed into deposits on their surfaces. Deposits that accumulate on the tube sheet are known as sludge piles and when they consolidate and harden become into hard sludge. Hard sludge is especially detrimental because it favors tube deformation or denting at the top of tube sheet and further stress corrosion cracking (SCC). These failures affect the efficiency of nuclear power plants. In a recent work, a model for the formation and consolidation of hard sludge has been formulated, highlighting the influence of aluminum and silicon compounds in the initial formation of hard sludge. In this work, an experimental study has been performed in order to get a deeper understanding of the behavior of Al and Si species in hard sludge formation and consolidation. For this purpose, the key components of hard sludge (magnetite, aluminum and/or silicon sources) have been isothermally autoclaved in representative secondary circuit conditions during one week, and the resulting products have been chemically and structurally characterized by XRF and XRD techniques, respectively.

Keywords : consolidation, hard sludge, secondary circuit, steam generator

Conference Title : ICBPCP 2018 : International Conference on Nuclear Plant Chemistry and Physics

Conference Location : London, United Kingdom

Conference Dates : June 28-29, 2018