Characterization of RPV Materials Harvested from the Decommissioned Zion Unit 1 Nuclear Power Plant

M.A. Sokolov, T.M. Rosseel, P.D. Edmondson, X. Chen, and R.K. Nanstad

Oak Ridge National Laboratory, Oak Ridge, TN, USA

The decommissioning of aging nuclear power plants (NPPs) presents a special opportunity to characterize the degradation of service-irradiated, reactor pressure vessel (RPV) materials and compare through-wall thickness attenuation and property distributions results with surveillance specimen test data. Moreover, it provides an opportunity to validate currently accepted codes such as ASTM E900 and physically-informed correlations of transition-temperature-shift predication models. The other major goal is to compare microstructural degradation observed in the test reactor or surveillance specimens to those in the actual decommissioned reactor pressure vessel steels. In this paper, we present the initial characterization of specimens machined from a segment of the Zion Unit 1 NPP. The segment includes a portion of the intermediate shell containing the circumferential weld (Linde 80 flux, wire heat 72105 [WF-70]) with a peak fluence (0.7×10^{19} n/cm^2, E > 1.0 MeV) on the internal surface of the Zion Unit 1 vessel. Following the determination of the through-thickness chemical composition, the initial testing focused on tensile, and hardness to characterize the through-thickness mechanical properties of beltline-weld materials. These studies will be followed with Charpy impact and fracture toughness testing. Moreover, microstructural characterizations have also been performed using Atom Probe Tomography.