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ASSESSING CRACKING RISKS AT TUBULAR JUNCTIONS OF THE TECHNOLOGICAL ROUTES USED IN NUCLEAR POWER PLANTS

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Abstract

According to the Association of Energy Services Professionals Survey, in the United States there were at least 56 accidents in nuclear power plants until 2010. Tubular branched structures are a common alternative for technological pipe systems, used for transportation of fuel elements and the primary coolant of a nuclear reactor. The tubular branched structures works at 5.1 MPa (or higher) internal pressure. The nuclear plant in Cernavoda is based on the CANDU system (Canada Deuterium Uranium). Tubular branched structures, under specific loads, due to geometrical discontinuities, they show strong concentration of mechanical stresses. The presence of welded surfaces involves a more complicated distribution of the mechanical stress, compared with the corresponding distribution for the typical elements, even at low pressures. There are some studies and researches showing the stress concentrator in the middle of the welding rim, but the authors show in this paper the influence of the geometrical discontinuities in the variation of the stress concentrator in the immediate vicinity. An experimental research was conducted upon the pipelines at 450 branched. The experimental results upon stress and strain were used to validate a numerical model that was used to analyze other angles for branched structures, low pressurized. The consequences of this paper are given by the possibility to determinate the risk of leak due to the crack appearance at buried tubular branched structures with less information: the geometry of the structure and the internal pressure.

Key words: crack risk, geometrical discontinuities, tubular branched structures

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