Brittle fracture assessment for LTO of WWER RPV

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The overwhelming majority of Ukrainian nuclear facilities have exceeded their design life. Thus, extending the service life of nuclear power plants to 60 years or more is a relevant and economically justified task. In the course of life extension activities, great attention is paid to assessing the brittle strength of nuclear power plant components, including the first circuit equipment. One of the most important topics in the field of nuclear power generation is the integrity of nuclear power plant reactor pressure vessels (RPVs). Therefore, the integrity of the RPV must be evaluated for both normal operation and emergency transients. The most dangerous emergency scenarios are associated with the loss of primary coolant accident (LOCA). The rapid cooling of the RPV wall combined with pressure, the so-called pressure thermal shock (PTS), causes high thermal stresses in the reactor wall and high stress intensity in existing cracks.
In our study, we would like to present the framework for calculating an emergency scenario with the LOCA, using the example of the WWER-1000 nuclear power plant. The main concerns for the long-term operation are welded joints No. 3 and No. 4, which are located in core area, thus irradiated. Alongside the weld material, cladding should be evaluated, for which a simple $J_1<J_{1c}$ criteria is applied.

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