

Dissertation Release

21.9.2020

The reactor pressure vessel and its internal components are suitable for long-term usage

Title of the dissertation	Susceptibility of boiling water reactor pressure vessel and its internals to degradation Kiehutusvesireaktorin reaktoripaineastian ja sen sisäosien altius vaarioitumiselle
Contents of the dissertation	The dissertation investigates the susceptibility of the boiling water reactor pressure vessel and its internal components to various significant degradation mechanisms. With a thorough literature study and several computational analyses it is demonstrated that for the examined structural parts, i.e. components, the operational life can be extended from the original 40 years to at least 60 years, and in case of the reactor pressure vessel even to 80 years. The analysis targets are nuclear power plant units OL1 and OL2 located at Olkiluoto in Finland and operated by the power company TVO. The reactor pressure vessel is one of the most significant and safety critical components in a boiling water nuclear power plant. It contains the nuclear fuel. A tailored screening process was developed for the internal components to determine the need for the degradation potential analyses. Brittle and ductile fracture analyses were done for the reactor pressure vessel and for all internal components pointed out by the screening process. The most significant considered degradation mechanisms include irradiation embrittlement, fatigue and stress corrosion cracking. A quantitative risk assessment procedure was developed for the considered components. For all components but one the computed risk class is moderate or lower. The conclusion is that for the analysed components the structural risks are in general very small and even in the one more severe case at an acceptable level.
Field of the dissertation	Structural mechanics, fracture mechanics, degradation potential analysis
Doctoral candidate	Otso Cronvall, licentiate of technology (Born 1969)
Time of the defence	09.10.2020 at 15 o'clock
Place of the defence	Remotely via Zoom https://aalto.zoom.us/j/69266178026
Opponents	Professor Robert Tregoning, US Nuclear Regulatory Commission, U.S. Professor Pål Efsing, KTH, Sweden
Supervisor	Professor Juha Paavola, Aalto University School of Engineering, Department of Civil and Structural Engineering
Electronic dissertation	http://urn.fi/URN:ISBN:978-952-64-0030-3
Doctoral candidate's contact information	Otso Cronvall, VTT Technical Research Centre of Finland Ltd phone 0505737599, email otso.cronvall@vtt.fi