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Computational Fluid Dynamics Analysis of Canadian Supercritical Water Reactor (SCWR) MOHAMMAD MOVASSAT, JOANNE BAILEY, METIN YETISIR, Canadian Nuclear Laboratories — A Computational Fluid Dynamics (CFD) simulation was performed on the proposed design for the Canadian SuperCritical Water Reactor (SCWR). The proposed Canadian SCWR is a 1200 MW(e) supercritical light-water cooled nuclear reactor with pressurized fuel channels. The reactor concept uses an inlet plenum that all fuel channels are attached to and an outlet header nested inside the inlet plenum. The coolant enters the inlet plenum at 350 C and exits the outlet header at 625 C. The operating pressure is approximately 26 MPa. The high pressure and high temperature outlet conditions result in a higher electric conversion efficiency as compared to existing light water reactors. In this work, CFD simulations were performed to model fluid flow and heat transfer in the inlet plenum, outlet header, and various parts of the fuel assembly. The ANSYS Fluent solver was used for simulations. Results showed that mass flow rate distribution in fuel channels varies radially and the inner channels achieve higher outlet temperatures. At the outlet header, zones with rotational flow were formed as the fluid from 336 fuel channels merged. Results also suggested that insulation of the outlet header should be considered to reduce the thermal stresses caused by the large temperature gradients.

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