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# THERMAL-HYDRAULIC MODELLING AND ANALYSIS OF A SMALL MODULAR REACTOR

A mathematical model has been developed to simulate the thermal-hydraulic performance for a near term deployable SMR of the integral pressurized water reactor (IPWR) design under normal operation. The energy equation and the heat conduction equation are solved analytically in order to predict the coolant, clad and fuel temperature distributions. The core active length is divided into axial regions and the fuel rod is divided into radial zones, nodal calculation is performed for two types of cooling channels; the average and the hot channels. Through this model, the heat flux leading to the Departure from Nucleate Boiling (DNB) as well as the Departure from Nucleate Boiling Ratio (DNBR) predicted at each axial node for each channel using EPRI correlation. High accuracy correlations and/or models valid under the reactor operating conditions are selected to estimate the heat transfer coefficients under single-phase forced convection, subcooled boiling and bulk boiling regimes. The vapor quality and void fraction are estimated for boiling regimes as well. The model is then used to simulate the reactor performance under different core cooling flow rates ranging from 10000 to 18000 m3/h and so different subcooling margins. The developed model can be used for selecting the appropriate core flow rate and subcooling margin and performing independent thermal-hydraulic safety assessment of the reactor core under steady-state operation as well.

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## Confirm that the work is original and has not been published anywhere else

Yes

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