Scaling Methodology for the DVI ECC Bypass Experiments

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Abstract

There exists a growing need to mechanistically evaluate the direct vessel injection (DVI) performance as part of the Korean Next Generation Reactor (KNGR) first-of-a-kind (FOAK) engineering. Since the experimental data are scarce in the open literature relating to the DVI emergency core cooling (ECC) bypass, selection of experimental parameters turns out to be a formidable task by itself. As the first step of experimentation, it is necessary to establish the DVI ECC bypass scaling methodology. In this paper, DVI ECC bypass scaling has two categories. One is the global condition related to the thermal condition scaling. Consisting of the core power and vapor condensation this may easily be applied to the whole KNGR system. The other is the local condition relevant to the momentum controlled scaling. This condition is combined with the thermal controlled condition. The resultant parameters are applied to design of the DVI ECC bypass experiment. They determine the diameter of the test vessel, the working fluid, the simulated ECC water injection velocity, and the heater power. These parameters may be used to generate various experimental conditions. The result of this study can be applied to the simplified DVI system in a straightforward manner.