

ECC Water Bypass in the Downcomer with DVI  
of APR1400 under LBLOCA

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Abstract

In the present study, several experiments related to the thermal-hydraulic phenomena in the downcomer with DVI under LBLOCA (Large Break Loss of Coolant Accident) were carried out using the experimental facility of plane-channel type scaled down as 1/7 ratio of prototype reactor (APR1400). Especially, phenomena such as ECC (Emergency Core Cooling) water entrainment and mixing in the downcomer were focused in the present study. Water film spreading is studied and compared with the full-scaled experiment and the experiment with a 1/7 scaled cylindrical-type test section to see the scaling effect and its curvature effect, respectively. It turns out that the curvature effect is negligible and the present modified linear scaling law is more appropriate than the linear scaling law. The water height in the downcomer and the amount of ECC water bypass by onset of sweep-out were measured from the visual observation of sweep-out in the downcomer. From this test, the onset of continuous sweep-out was used to analyze the water height in the downcomer. The amount of ECC water bypass by sweep-out was measured and compared with the UCB and KfK correlations. It is found that the best fit of the data from the present experiment lies between the predictions by the two correlations. ECC water mixing phenomena in downcomer were observed focusing on the ECC water film behavior. From the air and water mixing tests, it is concluded that ECC water bypass fraction is highly dependent on DVI position rather than gas flow rates and ECC water bypass fraction is less than 10 % of injection ECC water. From the steam and water mixing tests, it is concluded that ECC bypass fraction with steam injection is under 1.5 % and much less than that with an air injection because of the condensation in the downcomer.