ANALYSIS OF CRITICAL INLET HEADER BREAK LOCA EXPERIMENTS IN THE RD-14 TEST FACILITY

by

N.K. Popov* and G.R. McGee
Atomic Energy of Canada Limited
Whiteshell Nuclear Research Establishment
Pinawa, Manitoba ROE 1LO

Abstract

Blowdown and refill phenomena were observed and analysed in the full-elevation, CANDU-typical, RD-14 test facility during a series of critical inlet header break experiments. The objective of the analysis was to obtain a clear physical understanding of the mechanisms leading to, and the consequences of, periods of flow stagnation in either of the two heated sections representing CANDU fuel channels.

Six experiments are analysed in this paper, including break sizes of 27, 30 and 35 mm. The experiments were done with or without the primary pumps ramped down exponentially. It was found that the flow behaviour in the loop could be suitably analysed during the transient using diagrams displaying the pressure distribution around the loop at various times.

The analysis has shown that the brief flow stagnation in the heated section downstream of the break was caused by, and occurred during, pressure equalisation between the broken header and the downstream outlet header. The later flow stagnation in the heated section upstream of the break was caused by flow restriction at the pump located close to the break, and by general pressure reduction in the loop. Later, in all experiments, the Emergency Coolant Injection (ECI) system readily refilled both heated sections, and they remained well-cooled until the experiment was completed. The highest sheath temperature peak, approximately 580°C, occurred at the central pin during early flow stagnation in the heated section downstream of the break for break sizes of 30 and 35 mm.

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* Post-doctoral fellow of the Natural Sciences and Engineering Research Council of Canada, from the University Kiril & Metodij, Electrical Engineering Department, 91000 Skopje, Yugoslavia.