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THE DESIGN AND EXPERIMENTAL VALIDATION OF AN EMERGENCY CORE COOLING SYSTEM FOR A POOL TYPE RESEARCH REACTOR

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This paper presents the design of the Emergency Core Cooling System (ECCS) for the IEA-R1 pool type research reactor. This system, with passive features, uses sprays installed above the core. The experimental program performed to define system parameters and to demonstrate to the licensing authorities, that the fuel elements limiting temperature is not exceeded, is also presented. Flow distribution experiments using a core mock-up in full scale were performed to define the spray header geometry and spray nozzles specifications as well as the system total flow rate. Another set of experiments using electrically heated plates simulating heat fluxes corresponding to the decay heat curve after full power operation at 5 MW was conducted to measure the temperature distribution at the most critical position. The observed water flow pattern through the plates has a very peculiar behavior resulting in a temperature distribution which was modeled by a 2D energy equation numerical solution. In all tested conditions, the measured temperatures were shown to be below the limiting value.

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A MTR FUEL ELEMENT FLOW DISTRIBUTION MEASUREMENT PRELIMINARY RESULTS

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An instrumented dummy fuel element (DMPV-01) with the same geometric characteristics of a MTR fuel element was designed and constructed for flow distribution measurement experiments at the IEA-R1 reactor core. This dummy element was also used to measure the flow distribution among the rectangular flow channels formed by element fuel plates. Two probes with two pressure taps were constructed and assembled inside the flow channels to measure pressure drop and the flow velocity was calculated using pressure drop equation for closed channels. This work presents the experimental procedure and results of flow distribution measurement among the flow channels. Results show that the flow rate in the peripheral channels is 10 to 15% lower than the average flow rate. It is important to know the flow rate in peripheral channels because of uncertainties in values of flow rate in the open channel formed

by two adjacent fuel elements. These flow rates are responsible by the cooling of external fuel plates.

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