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Development and Validation of EBRDYN code by Benchmark Analysis of EBR-II SHRT-17 Test

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Experimental Breeder Reactor (EBR-II) was a U-Pu-Zr metal-alloy fueled liquid-metal-cooled fast reactor, extensively used for conducting safety experiments. Out of several tests conducted, the SHRT-17 loss of flow test conducted in 1984 demonstrated the decay heat removal capability by natural circulation in sodium cooled fast reactor with no core damage. In order to utilize the data recorded during these tests for improving the computer codes by extensive code validation, IAEA has initiated a coordinated Research Project (CRP) in which IGCAR, INDIA is one of the participants.
IGCAR has developed a plant dynamics code EBRDYN, on the same principles as Indian safety codes FBRDYN, DYANA-P and DHDYN used for the safety analysis of Indian Fast Reactors FBTR and PFBR. The EBRDYN consists of thermal hydraulic models of various components of EBR-II primary heat transport system viz., core, hot upper plenum, Z-pipe, intermediate heat exchanger (IHX), cold pool, primary sodium pumps and associated piping. All the subassemblies (SA) of the core are grouped into a convenient number of radial zones receiving sodium from bottom plenum and discharging into the top hot plenum. The instrumented SA models can predict the thimble flow and its heat transfer with the SA sodium. The mixing of sodium in the hot plenum, dynamics of Z-pipe, heat transfer in IHX from primary to the secondary sodium have been modeled. The primary sodium pumps have been modeled using homologous characteristics and with previous EBR-II experience. The pump models are capable of handling negative flows. The primary sodium circuit has been modeled with the capability to handle two primary pumps operating in parallel. The initial conditions of the reactor and transient boundary conditions viz., core decay power, primary pumps speed, IHX secondary sodium flow rate and inlet temperature as provided by Argonne National Laboratory (ANL) have been used. The steady state results are comparing well with the measured data. Most of the transient parameters viz., primary pumps flow rate, core outlet temperature evolution, Z-pipe inlet temperature, cold pool temperature are comparing well with the measured data. The full paper gives the details of the thermal hydraulic modeling of the primary heat transport system, the transient results and their comparison with the measured data and the effect of uncertainties in various parameters on the transient results.

Note: EBR-II Benchmarks CRP Poster Session

Country/Int. Organization

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