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Application of the coupled thermalhydraulic - fuel behaviour code FRAPTRAN/GENFLO in LOCA test evaluations.

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ABSTRACT

The general thermal hydraulic model GENFLO, developed and applied at VTT, and the coupled model FRAPTRAN-GENFLO, with a detailed fuel description, have been used to analyse and evaluate the preparatory phases in the Halden LOCA test IFA-650.

To take into account the features of the Halden LOCA test rig, it was necessary to improve the radiation heat transfer modelling and to introduce a model of the electric heater that surrounds the rod in the test setup. A basic model for the spray included in the test facility was developed, as well. With the complemented GENFLO code, one can optionally describe the thermal hydraulics of the whole loop without a separate system code.

The first series, IFA-650.1 comprised of six runs with, contrary to the final test, an unirradiated and unpressurized fuel rod. The results of GENFLO calculations made after the test conduct in May 2003 with qualified design and test data are presented.

The runs were repeated with the FRAPTRAN-GENFLO combination. Finally, calculations with pre-pressurised fuel were made so as to prepare for the up-coming second phase IFA-650.2 (planned for May 2004). The effects of fission and electric heating powers and the fill gas pressure on the expected cladding deformation are reviewed.

It is concluded that the planning and analysing of the Halden LOCA tests, and similar, could continue to benefit from the type studies the recent development of the FRAPTRAN-GENFLO code has made possible.

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