

PEARL reflooding research programme [ANALYTICAL EXPERIMENTAL PROGRAMME ON DEBRIS BED REFLOODING]

The experimental research programme, PEARL, studies complex two-phase flows (water/steam) in a porous medium such as a debris bed (540 mm diameter and 500 mm high) heated to a high temperature. Recent knowledge acquired with the PEARL facility is required to simulate the reflooding of a severely degraded reactor core.

During the reflooding of a degraded core, the coolant flows through the warped structures whose geometry and porosity vary locally. The reflooding models in the ICARE/CATHARE V2 computer code are based on the description of the core as a porous medium with a given geometry. These models will be validated thanks to the results of the PEARL programme in particular.

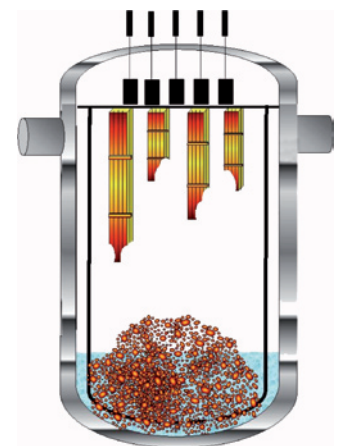
The debris in the PEARL facility is composed of stainless steel particles with diameters of 2 to 8 mm which are heated by induction to simulate the decay heat. The instrumentation in the debris bed serves to characterise the 3D flows in the porous medium during reflooding which is simulated by injecting water into the test section. They also help quantify the effect of parameters such as the water injection rate, the particle size, the power deposited in the debris bed, and the steam pressure.

This experimental programme is one of the keys to research conducted on a European level within the scope of the SARNET network of excellence (7th FP). The validation of models using the results from PEARL will particularly help to improve the accuracy and reliability of simulations.

The aim is to resolve two safety issues using these simulation tools:

- Optimising the strategy to follow in the event of a severe accident, particularly the severe accident response guidelines (SIAG) in terms of make-up water management,
- Assessing the possibility of stabilising corium in the reactor vessel.

Feasibility studies and instrumentation qualification tests are being performed on the PRELUDE mock-up with the purpose of validating the technical options for PEARL.



Simplified diagram of a severely degraded PWR core

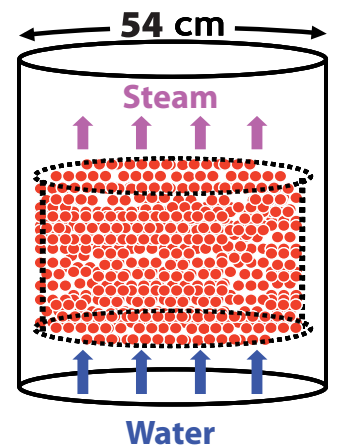


Diagram of the test section

