The severe accident research programme called Phébus FP aims at reducing uncertainties concerning the evaluation of radioactive fission product releases in the event of a Pressurised Water Reactor (PWR) core meltdown, as well as improving IRSN’s expertise and crisis management capacities in this field. To reach such objectives, tests reproducing the main physical phenomena governing a pressurised water reactor core meltdown, including the transfer of fission products from the fuel to the reactor containment and the evolution of these fission products have been carried out in an experimental device that is representative of a PWR and installed in the PHEBUS reactor. Led in collaboration with numerous French and foreign partners (EDF, European Commission, United States, Japan, Canada, South Korea and Switzerland), this programme includes a total of 5 tests.

**Objectives**

A first series of 3 tests (FPT-0, FPT-1 and FPT-2) made it possible to study the influence of the irradiation rate and the environment (oxidising or reducing) upon fuel degradation, the release and transport of fission products (FP) and the behaviour of these fission products in the reactor containment. These three tests were carried out using an Ag-In-Cd alloy control rod representative of Westinghouse-type PWR control rods, whose influence upon the behaviour of fission products was demonstrated.

Another test (FPT-4) focused on the ultimate phase of the accident and studying the release of low-volatile fission products and transuranics from a debris bed and a pool of molten fuel.

The fifth and last test (FPT-3) concerned the influence of a boron carbide (B,C) control rod—material used both in newer PWRs and in boiling water reactors operating in Europe and certain Russian reactors operating in Eastern Europe—upon fuel degradation and fission product behaviour. The results of the Phébus FP tests provide a considerable source of information needed to improve the simulation of core meltdown accidents. Computer programmes developed within the IRSN in this field, such as ICARE/CATHARE and ASTEC, benefit greatly from such test results.

**Sequence of a test**

A test can be divided up into two successive phases:

- The “degradation” phase lasts several hours during which the temperature of the test fuel is increased—by increasing the core power of PHEBUS—until the fuel liquefies and material starts to relocate (between 2,300 and 2,500°C), leading to the release and transport of fission products into the reactor containment. At the end of this phase, the PHEBUS reactor is shutdown.

- The “containment” phase lasts several days during which variables of interest are measured to better understand FP and structural material deposition phenomena, as well as iodine chemistry in the reactor containment.