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The SAIGA experimental program to support the ASTRID Core Assessment in Severe Accident Conditions

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The CEA, together with the NNC, has carried out a feasibility study with regard to conducting an in-pile test program - the future SAIGA program (Severe Accident In-pile experiments for Gen-IV reactors and the Astrid prototype) - on the degradation of an ASTRID-like fuel in the IGR reactor (Impulse Graphite Reactor operated by NNC). The purpose of the SAIGA program is to qualify the SIMMER computer code on the SEASON platform based on tests conducted with axially heterogeneous CFV type ASTRID inner core pins or pin bundles in hypothetical severe accident situations. These tests should be representative, as much as possible, for the phenomena encountered during severe accident sequences considered for ASTRID. The feasibility study aimed to study the generic accident families of loss of coolant and power excursion situations. It is important to point out that the fuel used for these tests can only be a non-irradiated fuel.

The feasibility study focused on tests based on the degradation of one or more fuel pins during Total Instantaneous Blockage (TIB) sequences in a sub-assembly and power excursion (Transient OverPower: TOP) sequences as in SCARABEE and CABRI with homogeneous pins.

For both scenarios, the feasibility study defined the main characteristics of the experimental devices and the operating conditions for the tests to be conducted in the IGR reactor. The purpose of the studies was to assess the capacity of the IGR reactor to provide the necessary neutron flux during all the transients, to demonstrate the capacity to carry out on-line or post-test measurements of the variables of interest, to study the feasibility of the sodium loop feeding the test device and to assess the cost and timetable for a program of 3 tests.

Preliminary calculations carried out using the SAS-SFR and SIMMER codes were used to simulate the degradation of the fuel during TOP and TIB type tests, respectively.

Based on the information obtained during the feasibility study, specification requirements were given to perform three useful and potentially feasible tests inside the SAIGA program i.e.:

- 1) Ejection and relocation of fuel in a narrow hydraulic channel (CFV type) with a heterogeneous fuel during a power excursion (TOP type scenario)
- 2) Loss of flow test on a CFV-type fuel sub-assembly
- 3) Propagation of a corium pool outside the sub-assembly in the presence of a corium discharge area filled with sodium

Country/Int. Organization

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