of the European Atomic Energy Community (Euratom)
for nuclear research and training activities (2007-2011)

Collaborative Project

EVOL

Project title:	**Evaluation and Viability of Liquid Fuel Fast Reactor System**
Project number:	**249696**
Project coordinator:	**Centre National de la Recherche Scientifique CNRS, Paris, France**
HZDR participant:	**Institute of Safety Research**
Starting date:	**01.12.2010**
Duration (months):	**36**

Summary

An innovative molten salt reactor concept, the MSFR (Molten Salt Fast Reactor) is developed by CNRS (France) since 2004. Based on the particularity of using a liquid fuel, this concept is derived from the American molten salt reactors (included the demonstrator MSRE) developed in the 1960s. The major drawbacks of these designs were (1) a short lifetime of the graphite blocks, (2) a reactor fuelled with 233U, not a natural fissile isotope, (3) a salt constituted of a high chemical toxic element: BeF2, and (4) a fuel reprocessing flux of 4000 liters per day required reaching a high breeding gain.

However, this concept is retained by the Generation IV initiative, taking advantages of using a liquid fuel which allows more manageable on-line core control and reprocessing, fuel cycle flexibility (U or Th) and minimization of radiotoxic nuclear wastes.

In MSFR, MSR concept has been revisited by removing graphite and BeF2. The neutron spectrum is fast and the reprocessing rate strongly reduced down to 40 liters per day to get a positive breeding gain. The reactor is started with 233U or with a Pu and minor actinides (MA) mixture from PWR spent fuel. The MA consumption with burn-up demonstrates the burner capability of MSFR.

The objective of this project is to propose a design of MSFR in 2012 given the best system configuration issued from physical, chemical and material studies, for the reactor core, the reprocessing unit and the wastes conditioning. By this way, demonstration that MSFR can satisfy the goals of Gen IV, in terms of sustainability (Th breeder), non proliferation (integrated fuel cycle, multi-recycling of actinides), resources (close U/Th fuel cycle, no uranium enrichment), safety (no reactivity reserve, strongly negative feedback coefficient) and waste management (actinide burner) will be done.