

International Nuclear Energy Research Initiative

U.S. DEPARTMENT OF ENERGY INTERNATIONAL NUCLEAR ENERGY RESEARCH INITIATIVE DOE/France

ABSTRACT

GFR Physics Experiments in the CEA-Cadarache MASURCA Facility

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Gas-cooled fast reactor (GFR) designs are being developed to meet Gen IV goals of sustainability, economics, safety and reliability, and proliferation resistance and physical protection as part of an International Nuclear Energy Research Initiative (INERI) project led by the CEA-Cadarache nuclear center in France and ANL in the U.S. The U.S. and French organizations are developing GFR concepts employing different coolants and fuel assembly geometries. The GFR designs include block-type, pintype, pebble-bed, and dual-particle cores using helium or CO₂ as coolant. In addition to the design studies, planning is underway at CEA-Cadarache for experiments that will investigate the core physics issues relevant to Gen IV GFR designs that were not addressed in previous gas-cooled reactor experiments. This effort, designated *Experimental Neutron Investigation on Gas-reactors at MASURCA* (ENIGMA), has the objectives of defining MASURCA configurations that are similar in their neutronic characteristics to the candidate GFR designs and of extending the validation domain of the neutronics tools to future GFRs design and licensing calculations.

ANL has participated in the initial planning phase for ENIGMA by evaluating the “representativity” of proposed experiments (i.e., their neutronic similarity to corresponding design concepts) for Phase 1. The objective of the current proposal is to extend this collaboration, by having ANL personnel participate in the ENIGMA project and evaluate experimental results with the intention of improving analytical models for GFRs. The scope of work for future collaborations include:

1. ANL will contribute personnel to the experimental teams for Phases 1 and 2. Phase 1 activities will be conducted in 2005-2006, and will include core characterization measurements, central substitution worths, and reflector studies for representative configurations of the demonstration plant – the Experimental and Technology Demonstration Reactor (ETDR). (The ETDR is a 20-50 MWt demonstration reactor to be built in Cadarache around 2010.) The Phase 2 activities will study the ETDR mock-up.
2. Perform neutronic sensitivity studies to support the definition and justification of the experimental program. Contribute to the definition and design of experiments and selection of integral parameters that will be measured to characterize the GFR systems.
3. Analysis of experimental results with the goal of improving reactor analysis tools for GFR design.

The U.S. activities for this effort would be done under Work Package A0802J01 of Gen IV Design and Evaluation Methods. This was also the basis for the collaboration in FY2004.
