Present Status in the Netherlands of Research Relevant to High Temperature Gas-Cooled Reactor Design

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Abstract

Research, relevant to the design of high temperature gas-cooled reactors (HTR), is performed in the Netherlands at NRG Petten/Arnhem, JRC-IE Petten (previously JRC-IAM) and IRI-Delft University of Technology, Delft. These present as well as past HTR activities in these organisations fit into an international –European and world-wide– framework.

An important role in these activities is played by the JRC’s High Flux Reactor (HFR) in Petten. Because of its favourable design and operational characteristics and the availability of dedicated experimental equipment, the HFR has been used extensively as a test bed for HTR fuel and graphite irradiations for more than 30 years. Since the First Information Exchange Meeting in 1999 new HTR-related irradiation experiments are being planned in the HFR irradiation program, e.g. HFR-EU1 (irradiation of fuel pebbles as part of the “HTR-F” project in the European Fifth Framework Program) and HFR-EU2 (irradiation of General Atomics fuel compacts).

Besides computational support for the irradiation experiments mentioned above – e.g. design calculations and prediction of sample composition after irradiation – more general HTR-related computational analyses and auxiliary investigations have been and still are being carried out by the organisations in the Netherlands, e.g. the INCOGEN study, investigations on the ACACIA combined heat and power concept, the South African PBMR, the chinese HTR-10 and the japanese HTTR and also on the implications of Pu-incineration in HTR systems and innovative burnable poison concepts. These analyses comprise computational HTR core physics, thermal hydraulics and shielding analysis, HTR system safety related transient analysis and also the development, improvement, verification and validation of software for performing these types of analyses.

Auxiliary investigations in the INCOGEN framework covered e.g. plant layout, design of the energy conversion system, control philosophy, inspection and maintenance, licensing, economics and market potential. Presently, auxiliary supporting experiments and studies are being carried out on chemical aspects of HTR fuel under final repository conditions and the compilation of a database of properties of potential HTR vessel materials, as part of the “HTR-N” and “HTR-M” projects in the European Fifth Framework Program, respectively.