

1. INTRODUCTION

On the recommendation of the International Atomic Energy Agency's International Working Group on Gas Cooled Reactors, the IAEA established a Coordinated Research Project (CRP) on the Validation of Safety Related Physics Calculations for Low-Enriched High Temperature Gas Cooled Reactors (HTGRs) in 1990. The objective of the CRP was to provide safety-related physics data for low-enriched uranium (LEU) fueled HTGRs for use in validating reactor physics codes used by the participating countries for analyses of their designs. Experience on low-enriched uranium, graphite-moderated reactor systems from research institutes and critical facilities in participating countries were brought into the CRP and shared among participating institutes.

The status of experimental data and code validation for HTGRs and the remaining needs at the initiation of this CRP were addressed in detail at the IAEA Specialists Meeting on Uncertainties in Physics Calculations for HTGR Cores [1.1] which was hosted by the Paul Scherrer Institute (PSI), Villigen, Switzerland in May of 1990.

The main activities of the CRP were conducted within an international project at the PROTEUS critical experiment facility at the Paul Scherrer Institute, Villigen, Switzerland. Within this project, critical experiments were conducted for graphite moderated LEU systems to determine core reactivity, flux and power profiles, reaction-rate ratios, the worth of control rods, both in-core and reflector based, the worth of burnable poisons, kinetic parameters, and the effects of moisture ingress on these parameters. Fuel for the experiments was provided by the KFA Research Center, Jülich, Germany. Initial criticality was achieved on July 7, 1992. These experiments were conducted over a range of experimental parameters such as carbon-to-uranium ratio, core height-to-diameter ratio, and simulated moisture concentration. To assure that the experiments being conducted are appropriate for the designs of the participating countries, specialists from each of the countries have participated in planning the experiments. Several of the participating countries also sent representatives to PSI to participate in the conduct of the experiments, as listed in Appendix A.

In addition, to the PROTEUS experiments, data from the LEU fueled critical experiments at the Japanese VHTRC critical experiment facility on the temperature coefficient (to 200°C) are of interest for physics code validation and were analyzed by CRP participants.

This report summarizes the existing base of information for validation of core physics design codes at the time that the CRP was initiated, describes the cooperative activities conducted within the CRP, provides information on the PROTEUS facility and the results of the critical experiments conducted, and summarizes the results of the validation activities conducted by the participants.

REFERENCES

- [1.1] Proceedings of an IAEA Specialists Meeting on Uncertainties in Physics Calculations for Gas-cooled Reactor Cores, Villigen, Switzerland, May 1990, IWGGCR/24, IAEA Vienna, 1991.