

DEVELOPMENT OF NEW GENERATIONS OF NUCLEAR REACTORS

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Introduction: The future of nuclear energy depends on the development of new reactors concepts that can meet requirements such as those defined by the US Department of Energy (DOE) for Generation IV nuclear energy systems. As nuclear engineers, we are responsible for this task.

Development of passive systems: The new generations of reactors have to make use of concepts like safety by design and the massive use of passive systems. In 1998 we started a research to study the effects of bypass lines in the hot-leg temperature of a system when operating in natural circulation. A Natural Circulation Loop (NCL) was built for this purpose and this research was ended in 2002. Since 2003 NCL is being used to study the effects of high contents of non-condensables in two phase operation of the system, to check the ability of RELAP5 to perform such kind of analysis.

National and international programs:

INPRO: IAEA, the International Atomic Energy Agency coordinates an international project to assess the potentials of the nuclear energy within those scenarios, with the aim of contributing with the development of global strategies, clarifying possibilities and defining requirements for that. This project is named INPRO, International Project on Innovative Nuclear Reactors and Fuel Cycles. During the year of 2003 we have directly participated in the INPRO Steering Committee.

IRIS: IRIS is an international effort to offer a reactor to meet the requirements for the Near Term Development Reactors, a step before the Generation IV reactors. Westinghouse started the conceptual design of this new reactor but, it was evident that a single company, or even a single nation, developing and deploying a nuclear plant could not succeed with such objective. Westinghouse invited few partners to joint in a consortium. Such approach immediately found a positive response around the world and the IRIS team grew from the initial four members and two countries to the present international consortium that comprises 22 organizations from nine countries. CNEN started its participation in the IRIS development in the beginning of 2001 and signed the collective IRIS agreement at the end of this year. Since then we have worked in the design and analysis of the IRIS pressurizer. We had approved two projects applied to the Energy Fund of CNPq: "Development of a Level Measurement System for Pressurizer and Reactor Vessels Using Temperature Probes and Artificial Intelligence Techniques", and "Social, Economic and Environmental Assessment of Energy and Water Desalination Options for the Brazilian Polygon of Drought

with IRIS Reactor". The second project is in cooperation with the Federal University of Pernambuco (UFPE) and with the Regional Center for Nuclear Science (CRCN). These projects were granted with a total amount of R\$ 163.000,00. Another project to develop a transient identification system was submitted to FAPESP. This project was approved in the beginning of 2004 with a total budget of R\$ 51.173,00. At the second half of 2004 we finalized a Research Project Proposal to the American Department of Energy (DOE). This project entitled "Development of Advanced Instrumentation and control for the Integrated Primary System Reactor" is being submitted as a Collaborative Proposal for the International Nuclear Energy Research Initiative. The American partners are the Oak Ridge National Laboratory and the Westinghouse Electric Company, U.S.A.

Brazilian navy program: The Brazilian Navy has a program, started in the early beginning of the 80s, with the objective to develop an advanced small reactor that can be used for nuclear propulsion. Most of the thermal-hydraulics division members have been working in this program since its beginning. At this moment we are providing technical assistance in the development of the LABGENE reactor protection curves.