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THE BRAZILIAN RESEARCH REACTOR IEA - R-1: PAST, PRESENT AND FUTURE "STATUS"

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Summary

The IEA-R-1 reactor is a pool type, light water moderated, and graphite reflected research reactor. It was designed and built by the Babcook & Wilcox Co. in accordance with specifications furnished by the Brazilian Nuclear Energy Comission. The first start-up was on September 16th, 1957, being the first criticality achivied in the Southern hemisphere. This paper, describes the evolution of the IAEA-R-1 reactor since its start-up, emphasizing its fuel and neutrocnics aspects. Also it is diescussed the present "status", and its near and far future potentiality.

The first core was a 5x6 arrangement designed to operate up to 5 MW. Several papers (1.2) published at the 2nd UN Geneva silicide fuel (U_3Si_2), berilium reflector, as potentially candidates for future improvements. Some discussion on the needs for reforming the components, systems and structures for incresing power (5 to 10 MW), as well as the impact of it in the radioisotope production will also be discusse l.

Conference describes the reactor at that time. Although, designed to operate at 5 MW it never operated at this power level, being operated at 2 MW since the early fifties, due to fuel failure problems. Since its first start up to the present time (september 1990), 162 core configurations had been instaled and in this paper this core configurations history will be briefly reviewed.

During its thirty three years of life, the IEA-R-1 has been utilized to produce radioisotopes (^{131}I, ^{32}P, ^{198}Au, ^{51}Cr, ^{24}Na, ^{82}Br, ^{60}Co, ^{192}Ir); research in nuclear physics, reactor physics, radiochemistry etc.; training; and providing services for users of other brazilian institution. Fulfaro et all (3) had summarized the IEA-R-1 utilization, and here we wish to review briefly these works.

Although the IEA-R-1 basic structures continues almost the same as in the original design, several improvements and changes in its components, systems and structure had been made along its life, the most important has been covering with steel liner the pool walls. Alvarenga (5), summarized these reforms, and here we also review these improvements.

The first fuel load was with curved plate, 20 w/o enriched fuel elements fabricated by B & W Co (40 fuel elements, including standard and control). It was used from 1957 to 1959, when some fuel corrosion was detected, and prompting its replacement. The second load, was also with curved plate, 20 w/o enriched fuel elements, but fabricated by United States Nuclear (39 elements), and operated until 1968. A third load of plane plates, 93 w/o enriched standard fuel elements were bought from the same company, and control elements (4) were changed to fork type and bought from a French Company. Many of these elements, includind control elements are still in the 162th configuration. In the beginig of eighties, with the international effort to change high enriched fuels (HEU) to low enriched fuels (LEU), five LEU fuel elements (20 w/o) were bought from NUKEN and introduced in the core, initiating the IEA-R-1 conversion to LEU. In parallel with this, efforts have been made to develope and fabricate Fuel Elements. In 1985 two prototypes (numers 128, 129) partial fuel elements (one with 2 plates, and other 10 plates) were introduced into the core for performance tests, and up to the present still are under investigation.

With the good performance of the brazilian fabricated LEU prototypes, it was decided to convert all the core with fuel produced by ourself, and in October 1988 a first totally brazilian facricated LEU, plate type (18 plates) was introduced in the core, and up to the present time 8 brazilian made fuel elements have already been introduced in the core. This paper will review the IEA-R-1 fuel elements history with an enphas s in those fabricated in Brazil, and in the neutronic and thermohydraulics studies of LEU

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Finally, the paper will discuss the near far term future of IEA-R-1, mainly neutronics, thermohydraulics, safety and operational peformance aspects. In the near future, it is expected to increase the power to 5 MW, and start a continuos operation (24 hrs/day) with oxide (U_3O_8-Al), brazilian made, LEU, fuel elements. In the long term it will be presented a 10 MW core coflguration using.

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