

THORIUM AND PLUTONIUM UTILIZATION IN PEBBLE BED MODULAR REACTOR

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Abstract

Thorium and plutonium utilization in Pebble Bed Modular Reactor is investigated with aim to predict the economical value of vast thorium reserves in Turkey. A pebble bed of the type designed by PBMR Pty. of South Africa is taken as the investigated system. Various combinations of uranium, thorium and plutonium are considered. Burnup calculations for equilibrium cores are performed and the amount of fuel material consumption is calculated. The work is still in progress and the results presented here are preliminary in nature.

Turkey has very large resources of thorium second to India's vast reserves. Even though there is no economical value of thorium as nuclear fuel presently, with the advent of High Temperature Reactors and especially the pebble Bed Modular reactor of PBMR Pty. of South Africa's design, the utilization of thorium in such reactors can be feasible in the near future.

In this work, the equilibrium core of a PBMR is considered and neutronic analyses of such a core is performed by using SCALE4.4 computer code system KENOVA module. Various cross section libraries are used to calculate the criticality of the core. Burnup calculations of the equilibrium core are performed by coupling the KENOVA module with the ORIGEN-S module. Calculations are carried out for various U-Th, U-Pu-Th combinations.

Effects of thorium utilization in PBMR are obtained from the comparison of two cases and the possible optimum choice is found by considering certain economical constraints on the operation of such power plants. The results are of preliminary in nature at present time and work is proceeding as planned.