

Investigation of Minor Actinide-Contained Thorium Fuel Impacts on CANDU-Type Reactor Neutronics Using Computational Method

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Abstract : Currently, thorium fuel has been especially noticed because of its proliferation resistance than long half-life alpha emitter minor actinides, breeding capability in fast and thermal neutron flux and mono-isotopic naturally abundant. In recent years, efficiency of minor actinide burning up in PWRs has been investigated. Hence, a minor actinide-contained thorium based fuel matrix can confront both proliferation resistance and nuclear waste depletion aims. In the present work, minor actinide depletion rate in a CANDU-type nuclear core modeled using MCNP code has been investigated. The obtained effects of minor actinide load as mixture of thorium fuel matrix on the core neutronics has been studied with comparing presence and non-presence of minor actinide component in the fuel matrix. Depletion rate of minor actinides in the MA-contained fuel has been calculated using different power loads. According to the obtained computational data, minor actinide loading in the modeled core results in more negative reactivity coefficients. The MA-contained fuel achieves less radial peaking factor in the modeled core. The obtained computational results showed 140 kg of 464 kg initial load of minor actinide has been depleted in during a 6-year burn up in 10 MW power.

Keywords : minor actinide burning, CANDU-type reactor, MCNPX code, neutronic parameters

Conference Title : ICNREE 2015 : International Conference on Nuclear and Renewable Energy Engineering

Conference Location : Zurich, Switzerland

Conference Dates : January 13-14, 2015