U.S. DEPARTMENT OF ENERGY
NUCLEAR ENERGY RESEARCH INITIATIVE
ABSTRACT

PI: Michael Todosow **Proposal No.: 2000-014**

Institution: Brookhaven National Laboratory

Title: Optimization of Heterogeneous Schemes for the Utilization of Thorium in PWRs to Enhance Proliferation Resistance and Reduce Waste

---

The thorium-U-233 fuel cycle promises a number of benefits relative to the conventional U-Pu cycle for commercial reactors, including reduced plutonium generation/enhanced proliferation resistance, reduced waste generation per unit energy production and reduced toxicity characteristics of the spent fuel. Heterogeneous assembly and/or core design options allow the flexibility needed to maximally realize the potential benefits of this cycle; this work is therefore complementary to a study of homogeneous approaches currently underway by a team headed by Idaho National Engineering Laboratory (INEEL). The assessments concentrate on key measures of performance, including: proliferation characteristics of the spent fuel focusing on quantity and quality of weapons usable material produced, fraction of power generated in U-233, safety, cost, and the characteristics of the waste stream. Key to this evaluation is the identification of any feasibility "go-no-go" issues, as well as areas requiring further study. The focus of the investigations will be on current and advanced pressurized-water reactor (PWR) designs (e.g., AP600 with its 17x17 fuel assembly), with the ability to retrofit into the envelope of a standard 17x17 fuel assembly, and utilize available control and burnable designs viewed as a positive attribute; some limited examination of “clean-slate” concepts will be performed as time and resources permit.
