

INTERNATIONAL NUCLEAR ENERGY RESEARCH INITIATIVE

Core Design Studies for Sodium-Cooled TRU Burner Reactors

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Project Abstract

This project will develop conceptual core designs for sodium-cooled fast reactors that transmute recycled transuranic (TRU) elements—which are the dominant contributors to spent fuel radiotoxicity, long-term heat, and dose. The objectives are 1) to develop the core designs for TRU burner reactors and 2) to perform relevant verification and validation analyses to support licensing requirements.

In the burner core design task, researchers will first examine various design concepts that enhance the TRU transmutation rate under practical design constraints and then develop optimum core designs for different conversion ratios and power levels. They will also investigate different design options to minimize the burnup reactivity swing and to improve the reactivity feedback coefficients.

The design method verification and validation task will include high-fidelity simulations and analysis of fast critical experiments. Detailed benchmark analyses will be performed for the ZPPR-15, ZPPR-21, and BFS-73-1 critical experiments. Researchers will also conduct a sensitivity analysis of cross sections and computational methods to ascertain their effect on neutronics performance parameters and they will evaluate the uncertainties of performance parameters.