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Conceptual Study of Fusion–Fission Hybrid Reactor for Transmutation of a Nuclear Waste

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The concept of a fusion-driven transmutation reactor based on LAR (Low Aspect Ratio) tokamak as a neutron source is studied based on ITER physics and technology. The radial build of transmutation reactor components are self-consistently determined by coupling the systems analysis with radiation transport analysis and an optimal configuration of a transmutation reactor for aspect ratio, A in the range of 1.5 to 2.0 is found. The performance of a transmutation reactor is investigated and shows that a transmutation reactor with a neutron source producing fusion power less than 150 MW can destroy the transuranic actinides contained in the spent fuels produced from more than two 1 GWe PWRs with production of the fission power being greater than 2 GW.

Keywords: Transmutation, Fusion-fission hybrid reactor