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Title: Dynamic System Model of the LS-VHTR to Estimate Design Parameter Impacts on Safety Margin and Reactor Economics.

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Early reactor analysis work for DOE's Liquid Salt–Very High Temperature Reactor (LS-VHTR) concept has focused primarily on detailed analyses of the core. This paper discusses ongoing analyses of the balance of plant and how it impacts overall system design. A dynamic system model of the end-to-end LS-VHTR has been developed to investigate the impact of major design parameters on systems performance, safety margin, and overall plant economics. The core model uses simplified thermal-hydraulic analyses to calculate average-, hot-, and blanket-channel parameters during transients. The core model is coupled to a multireheat Brayton power conversion system model through an intermediate salt-coolant loop model. Safety-related heat-removal systems, both passive and active, are modeled as well. Critical parameters, such as peak fuel and vessel temperatures and peak temperatures and pressures in the power conversion loop, are calculated during transients. The impacts of design parameters on component design requirements, safety margin, and economics are discussed. Transients initially analyzed include loss-of-coolant-flow accidents with reactor scram and loss-of-electrical-load transients. For initial transients, the axial- and radial-power profiles within the core will remain constant, with power levels decreasing in proportion to the time-dependent decay heating rate of the fuel. Later transients will represent spatial core power shifts during transients without scram. Results from simplified economic models will support relative comparisons among system design options.