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A solution vessel design study using multiphysics calculation

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ABSTRACT

A design study of generic solution vessel configurations was conducted to assess the effect of solution vessel configuration on a generic fissile solution system. The multiphysics (TH + Neutronics) calculation is utilized to evaluate system characteristics with three different configurations. Two constraints are applied: 1) constant solution volume (300L), and 2) keff set to be 0.985 at cold start. Major change in three configurations tested is the aspect ratio of the solution vessel. An identical cooling configuration was applied. A series of K-code calculations was conducted at each vessel configuration to meet a desired subcritical criterion. Four different source neutron case were utilized to calculate the steady state system behavior (i.e. power, temperature, and height change). A maximum allowable system power density was predicted to be 0.84 kW/liter with a high aspect vessel design at a source neutron intensity of 5.832E14 [s-1]. In addition, progress made on the assessment of Nek5000 for solution vessel application and preliminary results on GMIS support are reported.