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# Thermal Hydraulic and Flow Vibration Analysis of Pin Bundle Designs for the GFR

M. T. Farmer
*Nuclear Engineering Division*
*Argonne National Laboratory*
*9700 S. Cass Avenue, Argonne, IL U.S.A.*
*Tel:1-630-252-4539, Fax: 1-630-252-6080, Email: farmer@anl.gov*

**Abstract** – The Gas-Cooled Fast Reactor (GFR) is one of six systems selected for viability assessment in the Generation IV program. As part of a CEA - US DOE Gen IV collaboration to develop a pre-conceptual design of a GFR, a general thermal hydraulic channel flow model was developed and applied to the reference GFR vertical pin bundle design to verify acceptable thermal hydraulic characteristics under full power operating conditions. With these results, modeling modifications were then made to evaluate horizontal bundle design options. The calculations for the horizontal case indicated that although acceptable fuel and cladding temperatures can be achieved under normal operating conditions, the overall core pressure drop exceeds that which would allow acceptable core cooling under natural convection flow conditions to develop under postulated accident conditions. On this basis, the vertical core bundle was further analyzed to verify acceptable performance from the viewpoint of flow-induced vibration. The results of these analyses indicate that the currently proposed 271 pin bundle design with three uniformly spaced grid spacers is acceptable from the viewpoint of turbulence-induced pin displacements. In addition, the design was found to be robust insofar as preventing vibration instabilities that could lead to fretting and wear during normal plant operations.

This paper provides a summary of the modeling approach and key results for this study that was carried out in support of the development of a pin bundle core design option for the GFR design under development as part of a CEA-DOE Gen IV collaboration.