

NUCLEAR ENERGY UNIVERSITY PROGRAMS

CFD Model Development and Validation for High Temperature Gas Cooled Reactor Cavity Cooling System (RCCS) Applications

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Abstract

This project will investigate water flow behavior in the reactor cavity cooling system (RCCS) of a very high temperature reactor (VHTR) under the passive cooling mode of operation. This study will focus on development of computational fluid dynamics (CFD) tools to study the complex phenomena in the standpipes during normal and off-normal transients. The project team will perform a small bench-top separate effect test well-equipped with instrumentations to provide full-field measurements of velocity and temperature distributions for validation of the computational tools. The RCCS standpipes surround the reactor pressure vessel, and during off-normal system operations forced convection water cooling in the RCCS is lost. In this case, water is passively drawn from an open line located at the bottom of each header tank. This project is complementing another team's studies in investigating in detail the scaling analyses and providing system-level phenomenological models that describe key flow phenomena during RCCS operation from forced to natural circulation single-phase flow and two-phase flow and flashing. The major proposed tasks are to:

- Develop a CFD model of the RCCS standpipes system.
- Conduct simple experiments for the RCCS standpipe design.
- Develop a computational model that will describe the overall RCCS behavior as it transitions from forced flow to natural circulation and eventual two-phase flow in the passive cooling mode of operation.