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FINAL CRADA REPORT

Date: 10/13/2009

CRADA Number: **0202101**

CRADA Title: **Computational Fluid Dynamics Modeling of Two-Phase Flow in a BWR Fuel Assembly**

CRADA Start/End Date: Start 6/23/2003; End 9/30/2008

Argonne Dollars: \$405,000

Participant Dollars: \$1,360,000

Argonne PI: Dr. Adrian Tentner

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Summary of Major Accomplishments:

A direct numerical simulation capability for two-phase flows with heat transfer in complex geometries can considerably reduce the hardware development cycle, facilitate the optimization and reduce the costs of testing of various industrial facilities, such as nuclear power plants, steam generators, steam condensers, liquid cooling systems, heat exchangers, distillers, and boilers.

Specifically, the phenomena occurring in a two-phase coolant flow in a BWR (Boiling Water Reactor) fuel assembly include coolant phase changes and multiple flow regimes which directly influence the coolant interaction with fuel assembly and, ultimately, the reactor performance. Traditionally, the best analysis tools for this purpose of two-phase flow phenomena inside the BWR fuel assembly have been the sub-channel codes. However, the resolution of these codes is too coarse for analyzing the detailed intra-assembly flow patterns, such as flow around a spacer element. Advanced CFD (Computational Fluid Dynamics) codes provide a potential for detailed 3D simulations of coolant flow inside a fuel assembly, including flow around a spacer element using more fundamental physical models of flow regimes and phase interactions than sub-channel codes. Such models can extend the code applicability to a wider range of situations, which is highly important for increasing the efficiency and to prevent accidents.

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