RERTR 2018 – 39TH International Meeting on
Reduced Enrichment for Research and Test Reactors

November 4-7, 2018
Sheraton Grand Hotel and Spa
Edinburgh, Scotland

Experimental validation of CFD turbulent models relevant for involute-plate reactor

Cezary Bojanowski, Aurelien Bergeron and Jeremy Licht
Nuclear Science and Engineering Division
Argonne National Laboratory, 9700 South Cass Ave, Lemont IL 60439, USA

ABSTRACT

There are three research reactors in the world having fuel plates curved as circle-involute: The Oak Ridge National Laboratory (ORNL) High Flux Isotope Reactor (HFIR), The Laue-Langevin institute (ILL) High Flux Reactor (RHF) and the Technical University of Munich (TUM) Research Neutron Source Heinz Maier-Leibnitz (FRM II).

All three reactors are currently using Highly Enriched Uranium (HEU) as fuel and all three are actively engaged in activities to convert to Low Enriched Uranium (LEU) fuel. For various reasons, these reactors have expressed interest in using computational Fluid Dynamics (CFD) tools to perform their Steady-State Thermal-Hydraulic (SSTH) safety calculations. Using CFD for this type of analysis represents generally a significant departure from traditional methods and acceptability by regulators is not straightforward.

This is why Argonne National Laboratory (ANL) and the involute reactors formed an informal group to help each other in this endeavor. This so-called “involute CFD” group aims at justifying the usefulness and legitimacy of using CFD tools for SSTH safety calculations. Activities include benchmarking, code-to-code comparison, V&V and technical support.

The present paper describes activities performed at ANL this past year that have focused on understanding and validating the turbulent models used in CFD tools. Benchmarking of the Griess and Gambill experiments has been performed. Preliminary results tend to show that CFD turbulent models are able to reproduce well experimental heat transfer coefficients in geometries relevant to the involute-plate reactors.