



Seminarium Zakładu Energetyki Jądrowej i Analiz Środowiska (UZ3)
Departament Badań Układów Złożonych (DUZ)

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Reactor Cavity Cooling System for HTGR - geometrical sensitivity study

Abstract:

In the High-Temperature Gas-cooled Reactor (HTGR), the containment structure differs from standard Light Water Reactors (LWRs) and is typically designed to be non-leak-tight confinement. To maintain the pressure and temperature inside the containment and prevent heat buildup in surrounding structures, an engineered safety system, namely the Reactor Cavity Cooling System (RCCS), is employed. Shutdown heat is conducted radially from the inner core to the external walls of the reactor vessel (RPV), where it is then transported via natural convection and radiation to the RCCS heat exchangers. In the event of a loss of the primary cooling system and depressurization of the primary system, the RCCS serves as the ultimate heat sink within the reactor cavity, ensuring the cooling of the vessel and all internal structures.

Therefore, the RCCS plays a crucial role as a safety function, indirectly aiming to control reactivity by maintaining fuel temperature below the 1600°C limit during an accident scenario with an increased probability of fission product release. The requirements for RCCS performance and reliability can vary considerably depending on specific reactor design features, power level, materials, containment type, and licensing considerations. As each facility's RCCS design is unique and widely accepted, the geometry of both the RPV and RCCS, in terms of areas, distances, and view factors, plays a significant role in RCCS efficiency.

Let us explore the potential implications of altering the RCCS geometrical layout on heat transfer based on Computational Fluid Dynamics (CFD) analysis.

Serdecznie zapraszamy
Tomasz Kwiatkowski, Mariusz Dąbrowski

Bio:

Piotr Prusiński, MSc Eng. – senior CFD specialist at NCBJ focused on flow turbulence impact on heat transfer and their modelling by means of Computational Fluid Dynamics.