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CFD Modeling Challenges for Simulation of BWR Lower Plenum Injections

The USNRC office of Nuclear Regulatory Research has completed a series of simulations to study the stratification and entrainment behavior of a sodium pentaborate solution injected from the Standby Liquid Control System (SLCS) into the lower plenum of a Boiling Water Reactor (BWR). The simulation domain includes the BWR lower plenum along with the control rod drive tubes and major support structures as well as the SLCS piping.

A challenge for the Computational Fluid Dynamics (CFD) model development is the relatively large and complex domain along with the large variation in scales between the control rod drive structures and the SLCS jets. This requires a complex meshing strategy. In addition, the model is complicated by the need to resolve the high speed jets associated with the SLCS injection along with the relatively low flow rates associated with the relocation of the relatively heavy fluid driven by buoyancy forces and the surrounding flow field.

A series of initial runs has been completed which produced a qualitative understanding of the SLCS stratification and entrainment behavior. Further work in this area, which would include a benchmark study and further system analysis, is under consideration.

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NRC Office of Nuclear Regulatory Research

Conference:

[STAR Global Conference 2013](#) ^[1]

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