Numerical Investigation for the Effect of Guide Panel on Heat Transfer From Steel Containment

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Abstract

In nuclear reactor, containment is the last barrier for the release of radioactivity during severe accident conditions. Worldwide containments are designed to withstand the pressures postulated for design basis accidents (like Loss of Coolant Accident / Main Steam Line Break accident), while keeping in view of minimizing the escape of radioactive species and also for the external hazards such as flood, tornado etc.
Containment material could be concrete or steel or steel lined concrete; however each type has its own merits and demerits. Double containment made up of concrete material is generally preferred, however it is difficult to remove the energy released into containment, for longer period of time, during severe accident conditions due to low thermal conductivity of concrete. Steel containments have high load bearing capacity and high degree of leak tightness at higher pressures. To take the advantage of both, new containments are designed with steel containment surrounded by a thick RCC concrete structure (outer containment) for providing biological radiation shield for neutrons and gamma radiation. In case of Loss of Coolant Accident / severe accident, heat can be removed from containment in passive means. For this, a guide panel is provided, in the annular gap between the steel and outer containment, to increase the heat transfer from the steel containment. The heat transfer from the containment is depends upon annulus air flow through the gap between steel containment and guide panel. Hence the effects of annulus air gap on heat removal rate have been studied for a typical steel containment using COMSOL Multiphysics®.