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First-Principle Analyses of Gap Cooling Within the Reactor Vessel

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Abstract

First-principle analyses were performed to determine the maximum heat removal capability from the debris through the gap that may be formed during a core melt accident. Cases studied included four different nuclear power plants (TMI-2, KORI-2, YGN 3&4 and KNGR) per the thermal power output. Results of the analysis showed that the heat removal through gap cooling relative to flooding was efficacious as much as about 40% of the core material accumulated in the lower plenum. The three nuclear reactor (KORI-2, YGN 3&4 and KNGR) calculation results for heat removal through the debris-to-vessel gap size of about 1mm were compared with the TMI-2 reactor calculation results for the case of gap cooling alone.