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Decay-heat removal in accidents in fast reactors with liquid metal coolant

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The problem of decay-heat removal from a shutdown reactor is still pending and Fucushima accident proved it. The complexity of this problem grows with the increase reactor power.
High power reactors with sodium and lead coolants were analyzed and compared in terms of decay -heat removal using 3D thermo-hydraulic calculations of reactor cooldown.
Two DHRS designs are compared that differ by the location of emergency heat-exchanger. In the first design emergency heat-exchanger is located in the upper reactor chamber and heat is removed from reactor core due to following circulation path: "emergency heat-exchanger –upper plenum –inter-wrapper space of reactor core –upper plenum". In the second design emergency heat-exchanger is located in the downtake slit of reactor and design includes backflow valve that in cooldown mode allows "hot"coolant from the upper plenum to enter emergency heat-exchanger and blocking this flow while the reactor operates in power mode.
DHRS of a sodium reactor results to be more effective for both DHRS designs. As for the lead cooled reactor the second DHRS design also allows to remove after-heat without exceeding the allowed temperature limits. With the 1st DHRS design fuel rods overheat for a short period of time.

Country/Int. Organization

Russia/«Innovation and technology center for the «PRORYV» project»

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