INSTABILITY OF THE TWO-PHASE FLOW IN STEAM GENERATING CHANNEL

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Forecasting conditions of two-phase flow instability is important for ensuring the reliable operation of heat-exchange equipment in boiling modes. The occurrence of instability of the coolant flow can lead to deterioration of the operation modes of heat-exchange equipment and its destruction. The study of non-stationary processes and stability of two-phase flows is given special attention when substantiating the safety of NPP power units. At full power failure of the NPP cooling of the reactor core must be secured by the natural circulation of the coolant.

The most common type of instability in biphasic systems is the variation of the density waves. This instability is caused by many feedback links between the flow rate of the coolant, the rate of steam generation and the pressure difference in the steam generating channel.

The paper considers the influence of the coolant temperature on stability of the flow in the closed loop in the natural circulation mode. The loop includes a lifting section with a heated and unheated zone, condenser and lowering section where the single-phase coolant flows. The regime is considered when the density of heat flow on the wall of the steam generating channel remains constant and the temperature of the coolant at the entrance increases.

The underheating effect at entrance to heated channel on the stability of the natural circulation of the coolant is studied. A one dimensional nonstationary mathematical model of a two-phase coolant flow is presented. Boundaries of natural circulation instability region are determined depending on the coolant underheating at the entrance to the steam generating channel. Fluctuations in coolant flow rate are characterized by regular shape and an antiphase change in the flow rate at the outlet.

The ambiguous effect of underheating of the coolant at the entrance to the steam generating channel on the boundary of the stability of a two-phase flow is shown: at low values of underheating, its increasing destabilizes flow; at large underheating its increasing stabilizes the flow.