

system is developed, which is open for the expansion and realization of the corresponding functionality, in particular, the development of appropriate algorithms and software modules for interaction with the database and graphical user interface within the system.

CALCULATED STUDY OF DROPLET ENTRAINMENT PROCESSES OF BORIC ACID

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The processes of droplet entrainment of soluble substances with steam during the operation of nuclear power plants have a significant impact on the ecological situation. This effect can be expressed in increasing the humidity of the ambient air by using evaporative cooling towers or influencing the possibility of cooling the core of the reactor in the event of an accident. To study these processes in the IPPE, the calculated simulation of the droplet entrainment of boric acid was carried out, the results of which are presented in this paper.

Keywords: boric acid, droplet entrainment, reactor, accident, environment

Ensuring the safety of modern NPP projects in order to prevent accidents that can have a negative ecological impact on the environment is one of the most urgent tasks facing modern nuclear energy. Within the framework of the WWER-TOI project, special attention is paid to ensuring reactor safety in case of beyond-design accidents with a break in the main circulation circuit and loss of all AC sources within 72 hours. This task is solved by the functioning of passive safety systems that provide cooling of the core due to the consecutive supply of a solution of boric acid in the reactor with a concentration of 16 g / kg from the system of hydraulic tanks. As is known, the reactor core is at this time in a boiling state, correspondingly, taking into account the low acid concentration in the vapor phase, it is possible to increase the amount of boric acid in the core coolant and to achieve the conditions for its crystallization on the outer surface of the fuel rods, which may lead to a deterioration of the heat sink. The limiting concentration of a solution of boric acid, corresponding to the onset of crystallization, depends on the temperature.

To estimate the possibility of this process in the core of WWER, a calculation was made of the accumulation of boric acid in the reactor in the emergency mode. When carrying out the calculation, the following conservative assumptions were made: boric acid is considered as the only form of boron accumulation, boron drift of boric acid is absent. The results of the calculation analysis show that in the event of an accident, a sufficiently intensive accumulation of boric acid in the core of the reactor takes place. The maximum concentration of boric acid by the end of 72 hours significantly exceeds the limiting concentration [1], and, accordingly, can lead to its crystallization on the fuel element surface. The process of crystallization of boric acid in the core can be slowed down or even completely eliminated due to the removal of a part of boric acid with the vapor leaving the core. Therefore, in the future, in order to reduce the conservativeness of calculations, experimental studies of the processes of droplet entrainment processes of boric entrainment are necessary.

The results obtained will help to justify the safety of new NPP projects and ensure reliable operation of passive safety systems to guarantee that the accident does not transform to a serious stage, with the possible release of radioactive fission products into the environment and causing great environmental damage.

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