
NUCLEAR POWER PLANTS

Experience Acquired in Developing and Efficiently Using Information-and-Analytical Computer Systems on the Erosion-Corrosion Problem at the Power Units of the Balakovskaya Nuclear Power Plant

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Abstract—The authors describe the structure and functional capabilities of the information-and-analytical computer systems used for monitoring and control of the erosion-corrosion state of elements of equipment and pipelines of the secondary circuit at the nuclear power plant (NPP) that have been developed and installed at the Balakovskaya NPP (BalNPP). This paper presents the results of estimating the erosion-corrosion categorization and determining the service life of elements of equipment and pipelines until they exhibit inadmissible thinning, as well as data obtained from the statistical analysis of the effectiveness of the in-service control (thickness gauging) of elements of pipelines of a secondary circuit by example of the power unit No. 1 of the BalNPP.

Keywords: Balakovskaya NPP, pipelines, metal, local erosion-corrosion, information-and-analytical computer system

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The worldwide practice shows that all equipment and pipelines of a nuclear power plant (NPP) that have been made of carbon steel and operate under conditions of the water flow and the moist steam flow are prone to erosion-corrosion. Sudden erosion-corrosion failures result in forced outages of the equipment and shutdown of power units, and are capable of adversely affecting their reliability and safety. Despite significant efforts to prevent erosion-corrosion, as before, there are cases of inadmissible erosion-corrosion thinnings and damage of elements of equipment and pipelines of power units installed at NPPs, irrespective of the types of reactor plants or water chemistry and flow sheets being used.

Experience accumulated in our country and abroad testifies that only a system-wide approach to the problem of erosion-corrosion of metal used at NPPs can provide their cardinal solution by eliminating sudden damages of elements of equipment and pipelines. According to data published by the Electric Power Research Institute (EPRI (USA)), introduction of measures with the framework of the long-term strategy of erosion-corrosion prevention makes it possible to significantly reduce the scope of the problems associated with erosion-corrosion to the scale that is appropriate to power units with the low level of erosion-corrosion wear of equipment and pipelines [1].

Specialists of the OAO VNIIAES (All-Russian Research Institute for Nuclear Power Plants Operation), ZAO Geoterm-EM, and OAO ENITs (Elektrogorsk Scientific and Research Center for Nuclear Power Plant Safety), with active participation of the personnel of NPPs and support provided by the Department of Materials Science of the OAO Concern Rosenergoatom, are engaged in the work on the development and implementation of information-and-analytical computer systems for solving problems associated with erosion-corrosion (hereinafter referred as the Systems or the System) [2, 3]. Such Systems are intended for carrying out efficient monitoring and control of the erosion-corrosion state of elements of pipelines of a secondary circuit at power units of NPPs for the purpose of eliminating their sudden failure and enhancing their erosion-corrosion resistance, as well as for reducing the cost of control-and-diagnostic and repair measures associated with metal erosion-corrosion. The System is a tool unique for each power plant and it is based on the specialized database that reflects the erosion-corrosion state of all elements of pipelines of the secondary circuit (Fig. 1).

In order to obtain initial information that, after appropriate processing, fill the systematized information block (SIB) of the specialized database in the form of initial data, the design and operating documentation has been collected and analyzed. As a