THE CONCENTRATION OF HYDROGEN IONS (PH) CHARACTERIZES THE REACTION OF WATER

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Abstract. *The pH value of the reactor water is set for reasons of corrosion resistance of the structural materials. The lower limit of 5.8 is determined by limiting the occurrence of electrochemical corrosion with hydrogen depolarization, the upper value of 10.3 is determined by the process of alkaline embrittlement of steels and zirconium alloys.*

Keywords: *Ion, reaction, hydrogen, alkaline, method.*

INTRODUCTION

Iron plays a key role in the corrosion and deposition processes in the primary circuit of a nuclear reactor. All materials used to manufacture primary circuit equipment are subject to corrosion to varying degrees, depending on their corrosion resistance and operating conditions. Limiting the content of corrosion products in the coolant is important because it reduces the rate of deposit formation on various surfaces of the circuit.

MATERIALS AND METHODS

Deposits on the surface of fuel assemblies (FA) can lead to an increase in the temperature of the cladding metal, which in extreme cases can lead to burnout of the cladding and release of nuclear fuel into the coolant. In addition, the formation of deposits contributes to uneven corrosion, since the potential of the corrosion products differs from the potential of the metal, which can lead to the formation of corrosion elements [2].

Corrosion products are activated during repeated irradiation in the active zone, which leads to an increase in the radioactivity of the equipment and complicates its maintenance and repair.

The ability of various compounds to form deposits depends on whether the

solubility (saturation) limit for the corresponding compound has been reached. Therefore, the lower the concentration of corrosion products, the less likely they are to coarsen and deposit on the surfaces of the primary circuit.

RESULTS AND DISCUSSION

Studies have shown that when the concentration of corrosion products (iron, chromium, nickel) is less than 0.2 mg/dm3, the probability of their deposition is minimal. When the concentration of iron in the coolant is less than 0.05 mg/dm3, monitoring of the chromium and nickel content may not be carried out. However, when the concentration of iron in the coolant is more than 0.05 mg/dm3, monitoring of the concentration of chromium and nickel is required, as well as taking measures to find and eliminate the causes of the increase in the concentration of corrosion products [3].

Copper.

Copper plays an important role as a component of the primary coolant of a nuclear reactor. Quality standards set a limit on the copper content at less than 0.02 mg/dm3.

Copper may appear in the primary coolant from corrosion products of copper-containing materials used in the primary circuit equipment, as well as from make-up water.

Copper, being an electropositive element, helps to accelerate the rate of the cathodic process of electrochemical corrosion. Studies show that divalent copper ions accelerate the cathodic process on materials such as zirconium to a greater extent than oxygen and hydrogen ions. This highlights the importance of controlling the copper content in the coolant to prevent accelerated corrosion and maintain the stability of the primary circuit equipment [4].

Nitrate ions play an important role in the process of regeneration of SVO-2 cation filters using nitric acid. After commissioning of a freshly regenerated filter, residual amounts of acid residue, expressed in the form of NO_3^- ions, may be washed away. To control this diagnostic indicator, monitoring must be carried out for 24 hours after commissioning of a freshly regenerated cation filter. Sulfate ions,

on the other hand, enter the primary circuit coolant together with make-up water and can also be part of the reagents added to the circuit. The presence of sulfate ions can lead to the formation of poorly soluble compounds with some cations, which contributes to the accumulation of deposits in the system. Monitoring the concentration of sulfate ions in the primary circuit coolant is important for maintaining the optimal operating condition of the system and preventing possible problems associated with the formation of deposits.

Monitoring of the mass concentration of total organic carbon is necessary to track the presence of organic substances entering the coolant both with oils and petroleum products, and in the form of products of destruction of ion-exchange materials as a result of radiolysis and thermolysis. In case of deviation of one or several standardized indicators within the limits of the 1st level of permissibility, the power unit is allowed to continue operation in the "hot" state for 24 hours from the moment of detection of deviations. If deviations are not eliminated during this time, the power unit is smoothly transferred to the "cold" state. In case of reaching the standardized indicators of the second level of deviations, the power unit is also smoothly transferred to the "cold" state. These measures are aimed at ensuring the safety and normal operation of the power unit when deviations from standard indicators are detected [5].

CONCLUSION

Water chemistry is an integral part of ensuring stable operation of the main and auxiliary equipment without defects and with maximum efficiency. This set of measures includes the use of various chemical reagents that have a certain effect on the chemical composition of the coolant and maintain it in an optimal state using systems controlled in the reactor compartment. The systems aimed at maintaining the water chemistry in the primary circuit include: chemical additives control system; bypass filtration system for cleaning the primary circuit coolant (SVO-1); water purification system used to eliminate organized leaks and flush the primary circuit (SVO-2); water purification system in pools for storing and processing boric acid (SVO-4); primary circuit feed and flush system.

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