System of primary circuit coolant treatment KBF

System of primary circuit coolant treatment (KBF) provides processing of boron comprising water in order to reuse condensate and boric concentrate for the primary circuit make-up.

The functions of KBF system are:

- Processing of boron comprising circuit water;
- Purification of boric concentrate;
- boric concentrate supply to boron comprising water storage tanks;
- purification of boric acid solution from boron comprising water storage tanks in case of deviation from required quality.

KBF system consists of some equipment groups:

- equipment group for boric comprising water supply on processing (supply pumps);
- equipment group which is included in the evaporator plant;
- equipment group for accumulation and purification of boric concentrate;
- equipment group of air-removing;
- armature;
- pipelines.

In normal NPP operation the system works periodically at accumulation of boric water in the coolant KBB storage tanks.

Boric circuit water from the coolant storage tanks goes to evaporator. Before this the coolant is heated by regenerative heat exchanger. Boric acid solution is concentrated in the evaporator to 39,5-44,5 g/dm³. Secondary steam is condensed in condenser. The condensate is supplied in the make-up water storage tanks by pumps through refrigerator. Noncondensed steam and gaseous impurities from condenser goes to refrigerator. Gases from refrigerator goes to special gas purification. Steam condensate flows to the condensate tank. Boiled down concentrate goes to boric concentrate tank through refrigerator. Then it is supplied to the filters. Obtained boric concentrate 40 g/dm³ is directed to JNK tanks.

There is scheme with two stages cation exchange for boric concentrate purification. On the first stage there is nonregenerative cation exchanger, on the second stage – regenerative cation exchanger. Then there is anion exchange filter. Experience of this scheme is confirmed by some principles:

• the majority of activated corrosion products of constructive materials and nuclear fission products is delayed by the first cation exchanger. It's regeneration results in great volume of acid radioactive waste;

- the majority of alkali cations is delayed by the first filter;
- the second cation filter provides thin purification for required quality solution maintenance.

Using of nonregenerative ionexchange filters allows to reduce quantity of liquid radioactive waste because there are no backwash, cleansing and regeneration.



Scheme 1. Principal technologic scheme KBF system

(AE – anion exchanger; CE – cation exchanger; KBB – system of coolant storage; KBF – system of primary circuit coolant treatment; KPF – drain water treatment system; JNK – high concentration boric water storage system)