

4.1.19. ELABORATION OF NDT, REPAIR AND DEFENCE TECHNOLOGY OF CONDENSER'S TG K-1000-60/1500-2(2M) TUBE'S METAL OF ZAPOROZHYE NUCLEAR POWER PLANT

Kazakevich M.L., Institute of physical chemistry,
named by L.V. Pisargevsky, NAS of Ukraine, Kiev;
Troitskiy V.A., Institute of Welding, named by E.O. Paton NAS of Ukraine, Kiev;
Tischenko V.A., Zaporozhye nuclear power plant, Energodar, Ukraine

Steam generator (SG) of PGV-1000M type intended for steam output in composition of energy loop with water-water energy power reactor and is a part of reactor's circulation loops.

In the turbine's work time steam-heatbearer of the 1st contour condenses in SG on horizontally situated heat exchanging tubes. Condenser tubes form a cooling surface, which divides steam and water parts of condenser. Internal steam's heat transfers to circulation water on it. The tube's longitude – 14 m, internal diameter – 26 mm, wall thickness – 1 mm, material MNG-5. The bunch of cooling tubes SG member's more than 80,000 elements, inside each of them circulates cooling substance – noncleaned technical water from pond's canal. In the same time the steam, condensate on tube's external surface SG, pass far through careful preparation.

Corrosion-active gases (O_2 , CO_2) are removed from condensate. It's cleaned from ferromagnet particles and desalted with ion-exchange resins. The measure's complex on water-chemical regime's safety must secure:

- minimum quantity of deposits on SG heat-transfer surfaces,
- SG's protection from corrosion and erosion,
- minimum volume of waste products, harmful for environment.

And all this considerable efforts found useless because of heat exchanging tube's defects-leakages. Thin wall tubes, made from Cu-Ni-Fe alloy easily damaged during exploitation because of corrosion and erosion. And all bouquet of admixtures, solved in cooling technical water, get to condensate. Entrance from this situation was found by defect tubes put out of action (entrance and exit of such tubes close on tube desk).

Such temporary measures make's it possible to improve the condensate's quality, but makes worse heat characteristics of "SG". There is a constant level of closed tubes, under which SG exploitation becomes ineffective.

It was the reason to execute a cycle of works on elaboration of:

- methods, instruments and equipment for NDT of SG's tubes;
- methods, equipment and materials for SG's tubes defects repair;
- methods, equipment and materials for SG's tubes surface defense against corrosion and erosion.

As a result it was elaborated complex technology which allows to restore completely the work of tube's bunch of condenser TG K-1000-60/1500-2(2M).

It's utilization includes:

- NDT along all tubes;
- detection of leakage's places;
- leakage's repair, including closed tubes;
- internal surface tube's defense from corrosion and erosion and as a result prolongation of resource.

The technology was tested on Zaporozhye NPP.