Application of eddy current testing for inspecting condenser tubing in PPC fossil power plants

Panagiota TSAGKARI [1] Antonios ANTONAKAKIS[1] and Theodoros THEODOULIDIS [2]

[1]Public Power Corporation, KDEP, Greece
[2]University of West Macedonia, Department of Energy Resources, Greece

Eddy current testing is traditionally used for inspecting heat exchanger tubing in power plants. These exchangers are of the shell-tube type and eddy currents are preferred due to their great speed and accuracy in flaw characterization. Available standard procedures for such inspections are based on the technique of phase analysis and specifically on the use of ASME (Section V, Article 8, Appendix I). However, the ASME procedure is better adapted to steam generator tubing like those found in PWR nuclear power plants where the flaws originate from the outside (OD) of the tube wall and is not particularly suited to flaws emerging from the inside (ID). Such flaws are uniform thinning or pitting and they are common with fossil power plant condensers made of copper alloy tubes. In this case we have to develop specific procedures following tests of tube mock-ups taking into account the history of the particular condenser. Within the framework of collaboration between PPC/KDEP and the University of West Macedonia we have developed a procedure for the inspection of heat exchanger tubes of the main condenser units of the PPC fossil power plants. In this work we present the main issues arising during such inspections and focus on a specific condenser of the Ag. Dimitrios power plant.

The specific tube bundles suffered from inlet corrosion which is caused by the turbulence of water entering the Admiralty Brass tubes. Countermeasures that were taken in the past by the plant maintenance involved the installment of either plastic or copper alloy (CuNiAl) inserts. The purpose of the inspection was to check the condition of these inserts and to monitor any additional corrosion that may have started meanwhile. The equipment used was quite sophisticated and allowed inspection at four simultaneous frequencies (sixteen information channels before mixing). Data was gathered on computer hard-disk and was analyzed later off-line. The area of interest where ID thinning was expected was close to tube end, tube expansion zone and also baffle plate. Thus, an additional step in the preparation of the procedure was taken apart from manufacturing similar calibration blocks. This step involved the simulation of the geometry by proprietary eddy current software and helped in understanding the effect of the various parameters prior to both the inspection and also to signal analysis. As a result of the inspection, very small corrosion was observed under some of the inserts, thus proving their adequacy in protecting the tubes. In addition, in some cases, a small but not alarming initiation of further corrosion was observed at the end of the inserts.