Abstract

The chemistry of the water used in cooling water systems is extremely complex. In addition, raw water supplies in South Africa are deteriorating due to industrial, urban and rural pollution. Traditional methods for the evaluation of the quality of this water e.g. Langelier Index have proven to be inadequate as insufficient chemical parameters are taken into consideration. MINTEQA2 is a thermodynamic computer model for determining the possible form in which the chemical species can exist in a solution.

Although there is long term experience within Eskom as to the treatment and minimum specifications allowed for cooling water systems, the MINTEQA2 model can assist in interpreting the chemistry of the system, especially for less experienced operators. One of its major advantages is that it can be used to predict at which points of the chemical system precipitation is likely to occur. It can also be used as a teaching tool, particularly in terms of physical chemistry. The model is particularly useful in predicting the chemistry of the micro-elements e.g. silica, barium, copper, manganese, iron, etc. and dissolved organic matter (DOM).

The Matla Power Station cooling system was monitored as the concentration of contaminants increased. The MINTEQA2 model was used to predict the speciation profile of the concentrating cooling water system. The significance of DOM and the presence of an iron hydroxide layer was investigated. The DOM suppresses the precipitation of calcite e.g. in recarbonated cooling water, if the DOM is doubled, the amount of calcite predicted to precipitate is decreased by 12.5 %, and the presence of an iron hydroxide layer results in the adsorption of all copper from solution.

The validity of the outputs of the computer model was confirmed by laboratory techniques and provided that kinetic constraints are taken into account, it has proven to be an acceptable predictive tool in a qualitative rather than quantitative sense.