

Abstracts**Turbine Deposition: Two Cases**

Andrew G. Howell and Robert Pritekel

Two coal-fired drum boiler units of similar vintage experienced both similarities and differences in turbine deposition patterns. Deposits containing copper, sodium, phosphate, sulfate, iron, chloride and silica resulted in damage and performance problems of varying extent for the two units. Root-cause problem evaluation, actions taken, and recommendations for further actions to address causative issues are discussed.

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Rigorous Calculation of Sodium-to-Phosphate Mole Ratios for Phosphate Treatment Programs

Emory H. Hull and Robert D. Bartholomew

The sodium-to-phosphate (Na:PO₄) mole ratio and/or free caustic concentration is the primary control parameter for most phosphate-based treatment programs. Traditionally, these have been determined by comparison with graphs of pH versus phosphate for various sodium phosphate solutions. Approximate methods of estimation have also been used. This paper presents a more rigorous calculation method of the Na:PO₄ mole ratio and free caustic concentration (which has been used for about a decade by Sheppard T. Powell Associates LLC and some of our clients). Calculated Na:PO₄ mole ratios and free caustic concentrations based on the method presented in this paper are then compared to those calculated using the approximate method published by Verib.

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On the Uptake Mechanisms of Organics from Natural Water – Investigations with Strong and Weak Base Ion Exchangers and Their Corresponding Copolymers

Volker Ender, Thomas Schumann, Susanne Sachs, and Gert Bernhard

In laboratory column experiments, ion exchange resins and the corresponding non-functionalized copolymers were compared in order to investigate the uptake mechanisms of organics during the water demineralization process. To improve the detection limit, ^{14}C -labeled model substances (β -alanine, starch, synthetic humic acid type M42) were used. These compounds are supposed to represent the TOC fractions of neutrals/amphiphilics, polysaccharides and humics following the LC-OCD method. The uptake was investigated depending on the salinity and pH, the concentration of the organics, and the loading temperature. The main results are:

- At neutral pH, a near 100 % removal of β -alanine and starch by ion exchange and/or adsorption was observed, whereas humic acid was taken up by ion exchange to an extent of about 10 %.
- In acidic conditions, β -alanine and starch were completely removed up to the breakthrough point of the sulfate ions. These elute the organics. Humic acid will be removed owing to precipitation.
- The last mechanism allows the removal of humic acid by the copolymers too. These are inefficient in regard to the uptake of β -alanine and starch.
- The variation in the concentration of the organics as well as that in the loading temperature have only a subordinate influence on the uptake.

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The Fate of Organics in the Water-Steam Cycle

Pavel Hübner

The behaviour of organic matter in power plants has been examined. The samples were taken from water treatment plants producing make-up water for boilers as well as from water-steam cycles and cooling cycles. The power plants examined were Czech power plants, both fossil and nuclear, and one Slovakian nuclear plant.

The tests were performed by the liquid chromatography – organic carbon detection (LC-OCD) method at a subcontractor lab. This method enables distinguishing between different groups of organic matter and from experience the effectiveness of water treatment technologies and the possible influence on the water-steam cycle of the power plant can be estimated.

It has been confirmed that by using appropriate flocculation the problems in water treatment plants diminish and the VGB limit for total organic carbon (TOC) concentration of $200 \mu\text{g} \cdot \text{L}^{-1}$ in boiler feedwater may be reached. The lower limit following EPRI recommendations of $100 \mu\text{g} \cdot \text{L}^{-1}$ is hardly achievable using existing water treatment technology. This provides an open field for reverse osmosis technology that is able to remove organics completely.

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Influence of Chloride and Carbon Dioxide on General and Crevice Corrosion of Steam Turbine Materials for Geothermal Power Plants

Hao-Feng Zhang, Li-Bin Niu, Shuji Oishi, Hiroshi Takaku, Kunio Shiokawa, Mitsuo Yamashita, and Yoshihiro Sakai

The influence of chloride and CO_2 on general and crevice corrosion of steam turbine materials for geothermal power plants was investigated in two simulated geothermal waters. The general corrosion rates of the rotor steels with a lower Cr content were accelerated due to the CO_2 in the water, while the corrosion rates of the blade steels with a higher Cr content were controlled mainly by the chloride concentration in the waters. Concerning the crevice corrosion behavior, the galvanic corrosion effects in each of the waters were confirmed for the rotor steels with lower corrosion potentials than those of the blade materials, and almost no difference in corrosion behavior was observed between the two waters tested. Regarding general and crevice corrosion in the two simulated geothermal waters, it was determined that a newly developed rotor material and also an improved heat-treated blade material are promising for actual usage in geothermal power plants.

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Water Pre-Treatment with Membranes: A Developing Technique for the Power Industry

Bradley Buecker

The paper describes the successful application of new microfiltration technology for suspended solids removal in a U.S. power plant in lieu of clarification/sand filtration. The process, results and problems encountered are discussed.

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