

Total Organic Carbon Measurement in the Power Plant

Application Note AN-0117

Background

Organics in power plant waters have a number of detrimental effects. They can foul resins in make-up and condensate deionizers and require more frequent resin cleaning and replacement. They can break down to organic acids that lower the pH of early condensate and cause turbine corrosion. They can deposit along with other contaminants onto heat exchange surfaces and significantly reduce efficiency. They can cause foaming in boiler drums and increase carryover of other contaminants into the steam.

For these reasons, total organic carbon (TOC) has been identified as an important measurement in power plant chemistry. Various limit values, ranging between 100 and 300 ppb as carbon have been set by organizations such as EPRI, VGB and Eskom for make-up water to the steam-water cycle. Make-up water is considered to be the major source of TOC contamination entering the plant chemistry cycle under normal operating conditions.

Makeup Water Measurement

Measurement of TOC in makeup water is straightforward using the method of UV oxidation with conductivity measurement before and after. Organics are broken down to carbon dioxide which increases conductivity. TOC is computed based on this increase. The Thornton 500TOC Sensor with 770MAX Multiparameter Analyzer/Transmitter meets this application requirement with especially fast response and reliability.

Steam-Water Cycle Measurement Details

Measurement of TOC in the steam-water cycle is not as simple as in makeup water samples. Most cycle chemistry treatments raise the pH with ammonia to a range near 9. If the sample were run directly through the direct UV oxidation TOC instrument, the carbon dioxide produced by organics oxidation would be neutralized by the ammonia, the conductivity would not increase, and TOC could not be determined. The measurement cannot be made directly.

For this reason, it is necessary to take the sample after a cation exchange column, the same as for cation (or acid) conductivity measurement. In fact, the TOC instrument can also provide the cation conductivity measurement. The sample after cation exchange will have the ammonia removed and the pH lowered so that additional carbon dioxide adds to the conductivity and TOC can be determined reliably. It is necessary to use high grade cation exchange resin that is fully rinsed and does not contribute organics of its own. The Thornton 5000TOC Sensor and 770MAX Multiparameter Analyzer/Transmitter provide excellent results on cycle chemistry samples when used with this kind of sample conditioning.



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AN-0117 Rev.A 7/08