# 厂性水-蒸汽回路中的在痕量分析

Thermal power plants use the heat generated by combustion or nuclear fission to produce high pressure steam, which is fed into a turbine driving a generator that converts the mechanical energy into electrical energy. Downstream of the turbine, the steam condenses to water, forming a vacuum critical for the power plant efficiency. This water is returned to a feed tank from where it is pumped back into the steam boiler. Cooling water flows through the condenser in a separate circuit, removing the heat of condensation released by the steam via a heat exchanger.

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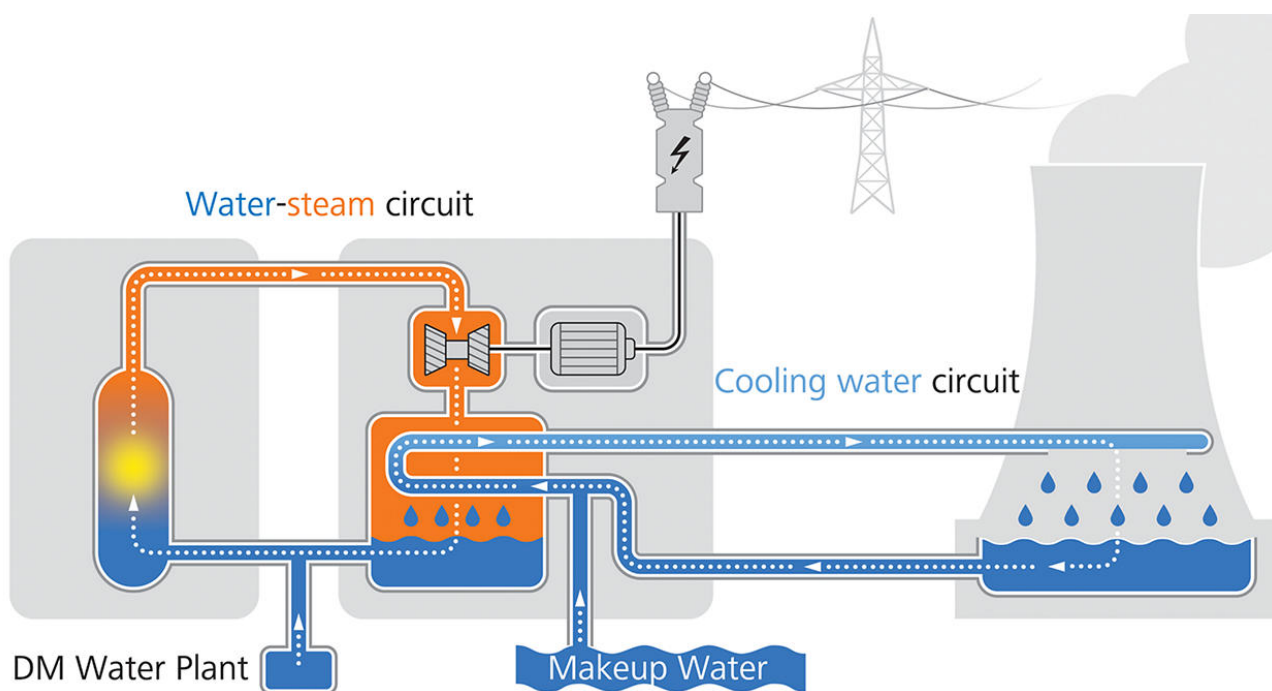
Figure 1. Diagram of a 2-water circuit power plant.

Unplanned maintenance can lead to costly and critical downtimes and corrosion is often the cause. Exceptionally low pH values increase the corrosion potential, whereas excessively high pH values destroy the protective layer on the metals. Adjustment of the pH value is challenging because the requirement for minimum corrosion and maximum protective layer leaves very little flexibility. To keep corrosion low, the pH value of the watersteam should be in a slightly alkaline range, frequently achieved with All-Volatile Treatment. In this treatment procedure, neutralizing amines such as morpholine, methoxypropylamine, and ethanolamine among others are added to the demineralized feed water to raise pH, inhibiting corrosion in steam condensate systems.

Frequent monitoring of the chemistry ensures safe and efficient power plant operation. Ion chromatography with conductivity detection provides an effective means to control amine addition in alkaline water-steam circuits of thermal power plants. Precise, reliable trace analysis requires the method to be automated as much as possible. Metrohm Process Analytics offers a complete solution for this task: **the 2060 Ion Chromatograph (IC) Process Analyzer** featuring the Metrohm intelligent Partial Loop Technique (MiPT) option.

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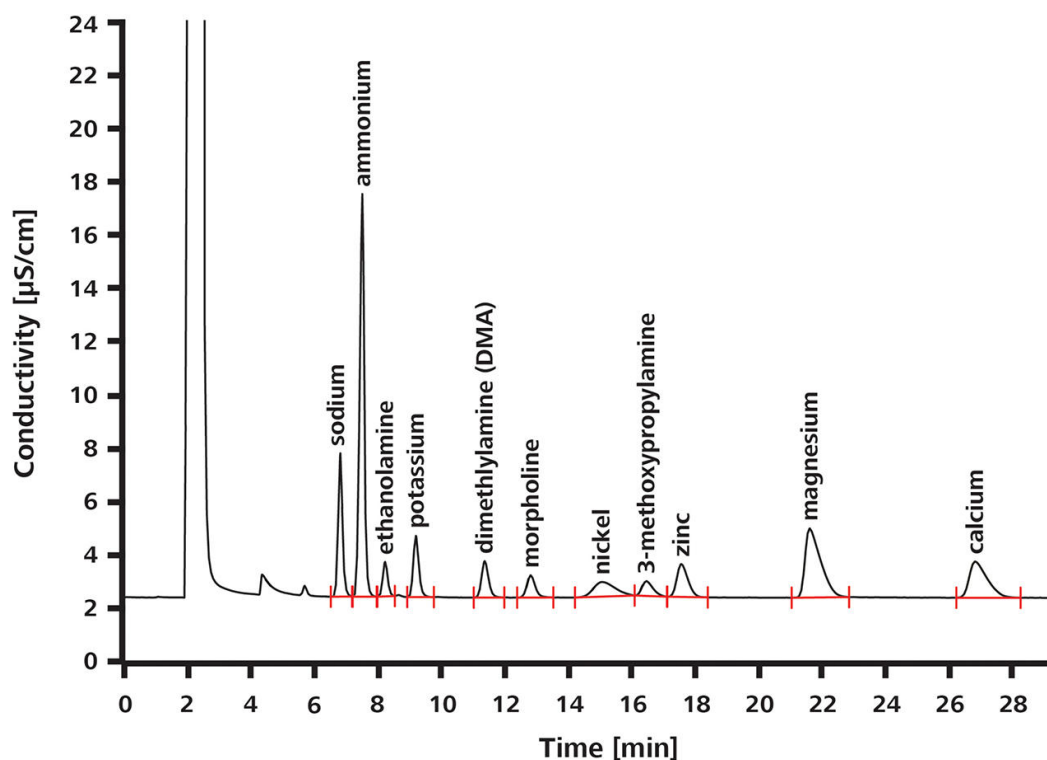
Figure 2. Chromatogram of a simulated water-steam circuit sample treated with 1 mg/L each: sodium, ammonium, ethanolamine, potassium, dimethylamine (DMA), morpholine, nickel, 3-methoxypropylamine, zinc, magnesium, and calcium; sample volume: 100 µL.

APPLICATION

In a single analysis, the 2060 IC Process Analyzer is able to measure numerous ionic compounds in aqueous media from ng/L to % concentrations. Most important is the sensitive determination of **sodium** next to the high **ammonium** or **amine** concentrations, because an increase thereof indicates that cooling water is seeping into the circuit. The analysis system is fed directly and continuously with samples via a bypass in the process. The Metrohm Partial Loop Technique allows, in addition to the automatic calibration feature, a working **calcium** and **magnesium** determination. Automated calibration guarantees excellent detection limits, a high reproducibility, and excellent recovery rates. Additionally, sequential cation suppression reduces baseline noise, considerably lowering the detection limits.
The analysis is carried out fully automatically. Analyte detection is by conductivity.

Figure 3. The 2060 IC Process Analyzer is available with either one or two measurement channels, along with integrated liquid handling modules and several automated sample preparation options.

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REMARKS

The column oven should be used in this application to maintain analytical column stability above room temperature (up to 40 ºC).

BENEFITS FOR IC IN PROCESS

- **Inline eluent preparation** ensures consistently stable baselines
- **Safe working environment** and automated sampling
- **High precision analyses** for a wide spectrum of analytes with multiple types of detectors
- Protect valuable **company assets** (e.g. pipes, PWR, and turbines, which are prone to corrosion)

FURTHER READING
Related application notes

AN-C-049 Trace cations in power plant feed water stabilized with 7 ppm monoethanolamine (MEA)
AN-CS-010 Traces of lithium and sodium besides monoethanolamine in water-steam circuits of thermal power plants
AN-C-139 Cations and amines in the water-steam cycle

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CONFIGURATION

2060 IC Process Analyzer

Metrohm Process Analytics 的 **2060 Ion Chromatograph (IC) Process Analyzer** 基于模化 2060 平台概念。模化的体系可将机分在工厂周的不同位置,并可接多 20 个本流,从而可在工厂内部的多个区域行省的序分析。

此分析在硬件、件和用定制方面没有限制。从淋洗液生成模、用于品滴定的取部模以及多个 IC 池,2060 IC Process Analyzer 具有任何工用需要的所有。

2060 件是一 "多合一" 件解决方案,可控制分析行常分析,并有不同的操作方法、表和。此外,由于程通信多多(例如 Modbus 或 Discrete I/O),可 2060 件行程,以向程送自反和警,并必要采取行(例如,重新量品或始清周期)。所有些功能可保每周 7 天全天候工程行全自断。

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