



Application Note AN-PAN-1044

Online trace analysis of amines in the alkaline water-steam circuit of power plants

SUMMARY

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.

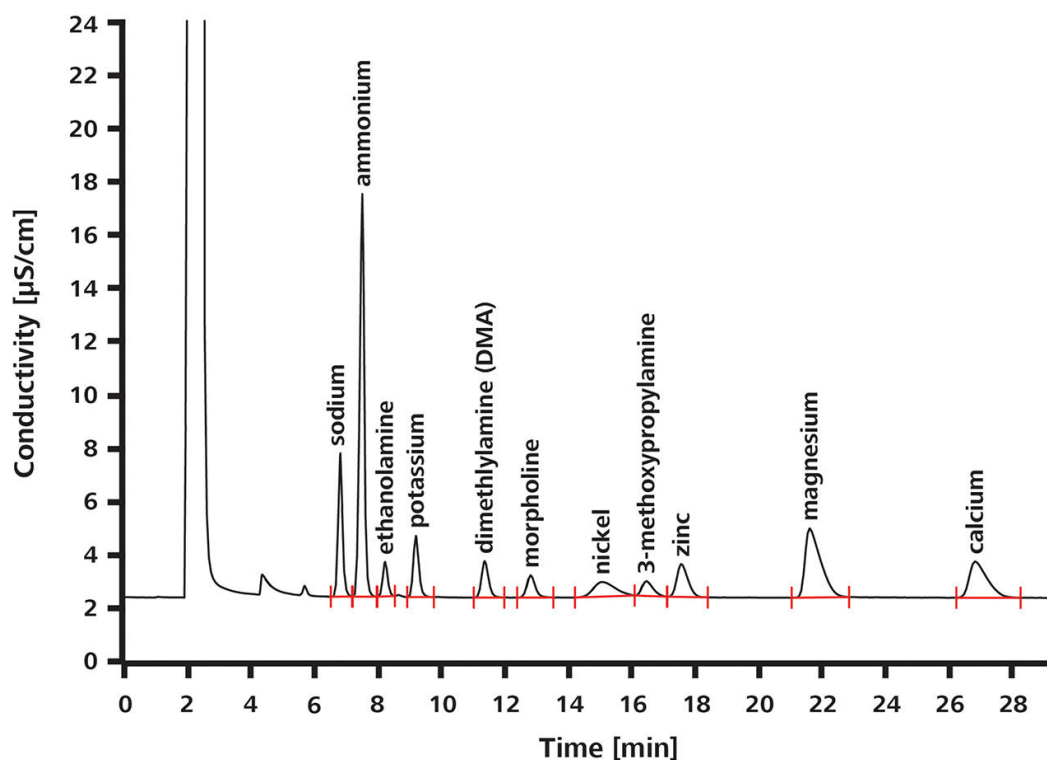


Figure 2. Chromatogram of a simulated water-steam circuit sample treated with 1 mg/L each: sodium, ammonium, ethanolamine, potassium, dimethylamine (DMA), morpholine, nickel, 3-methoxypropylamine, zinc, magnesium, and calcium; sample volume: 100 µL.

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.

REMARKS

The column oven should be used in this application to maintain analytical column stability above room

temperature (up to 40 °C).

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](#)

CONTACT

Metrohm Polska
ul. Centralna 27
05-816 Opacz-Kolonia

info@metrohm.pl

CONFIGURATION



2060 IC Process Analyzer

The 2060 Ion Chromatograph (IC) Process Analyzer from Metrohm Process Analytics is based on the modular 2060 platform concept. This modular architecture enables the separation of the cabinets in different locations around a plant and the connection to up to 20 sample streams for time-saving sequential analysis at multiple areas inside of a plant.

This analyzer has no limits in terms of hardware, software, and applications customization. From continuous eluent production module, wet part modules for sample conditioning, and multiple IC detector blocks, the 2060 IC Process Analyzer has all the options for any industrial application.

The 2060 software is an «all-in-one» software solution that controls the analyzer to perform routine analysis, with different operation methods, time sheets, and trend charts. Furthermore, thanks to the variety of process communication protocols (e.g. Modbus or Discrete I/O), the 2060 software is programmable to send automatic feedback and alarms to the process and take action if necessary (e.g., re-measure a sample, or start a cleaning cycle). All of these features ensure fully automatic diagnostics of the industrial process – around the clock, seven days a week.