

Steam Condensate Monitoring with Low Level Oil Contamination Warning

By Dr. Vadim Malkov and Dr. Dietmar Sievert

The Scenario

At the metal works plant, steam is used in a closed loop for process heating purposes. The steam heats up a mineral oil based heat transfer fluid. Any leakage of the steam/heat transfer fluid at heat exchanger surfaces causes contamination of the steam condensate with mineral oil. Even small traces of mineral oil contamination can cause severe corrosion in the steam generation cycle. In the past, a turbidimeter utilizing light scattering technology with a sample cooler was used to monitor the condensate for oil contamination. The presence of oil droplets in the water is necessary to be detected by a turbidimeter. In other words, no dissolved mineral oil can be detected using this technology.

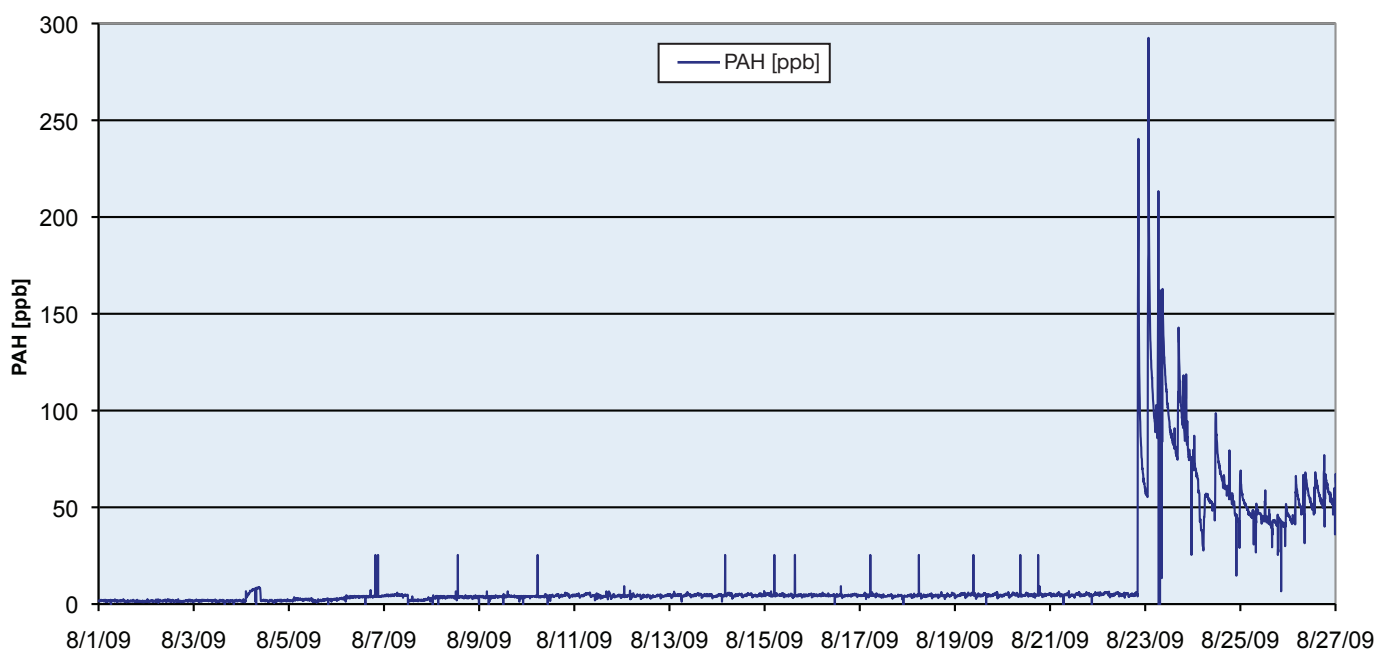
Mineral oils are soluble in water at very low ppm range, especially at higher temperatures. Therefore, it is not possible to get an early warning from a turbidimeter, as it's not able to detect dissolved oil in ppb or low ppm

concentrations. In addition, all other particles in the condensate will increase readings and can cause false alarms.

To allow for the detection of low level mineral oil contaminations, the Hach FP 360 sc oil-in-water (OIW) probe was installed for this application. Due to its sensitivity to low ppb levels of PAHs (Polycyclic Aromatic Hydrocarbons), a typical component of mineral (derived from petroleum products) oil, the sensor is capable of providing an early warning without any interference from particles or other components of the condensate water sample.

The probe with a flow cell was installed at the outlet of the turbidimeter (after the sample cooler), allowed for direct side-by-side comparisons of turbidity and OIW probe readings. For performance checks the customer pumped an oil/water mixture from a separate tank through the installed instruments. The FP 360 sc reacted quickly to

Condensate Monitoring



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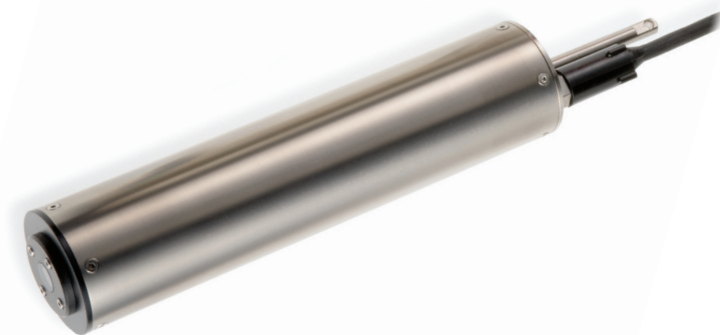
the test sample, while the turbidimeter responded with a significant delay. This was due to the fact that in the beginning of the test only water with dissolved oil was pumped through the loop, and only after some mixing time in the tank, the oil droplets reached the instruments.

A simple cleaning procedure involved wiping the probe's measuring window with a soft cloth and it was performed periodically during the testing period. The OIW readings went back to nearly zero after each performance check, even without the cleaning.

Changes in production required mixing condensate from a second tank into the water loop starting Aug. 22nd, 2009. The curve shows the FP 360 sc measuring signal before and after this change. A grab sample and lab analysis showed an oil contamination in the low ppm range. The turbidimeter did not show any response to the blending.

Test Conclusions

- The test demonstrated that UV fluorescence technology as used by the FP 360 sc probe shows significantly higher sensitivity to both dissolved and dispersed mineral oil in steam condensate than a turbidimeter.
- In addition, it is much more specific to oil and not affected by particles or other components in the sample causing the turbidimeter response.
- After the side-by-side test, the turbidimeter was replaced by the FP 360 sc.



ABOUT THE AUTHORS:

Vadim Malkov (Ph.D. Organic Chemistry, Kazán State University, Russia) joined the Research and Development division of Hach Company (Loveland, CO) in 2002. His work includes experimental studies in the area of process analysis of water quality in the industrial and municipal applications and he has more than 20 years of experience in various fields of chemistry. He has led and participated in development of several new process analyzers and applications in the area of water disinfection and corrosion control. He has published more than fifteen papers in scientific and professional journals as well as one US patent. Dr. Malkov has presented the results of his work at numerous conferences in the United States and abroad. He is currently working as a Product Applications Manager for the Process Instrumentation Business Unit (Hach Company). Phone: 970-663-1377 x 2689, vmalkov@hach.com

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