Integration of a Phosphate Analyzer in a Pro-active Maintenance Concept for Water Quality Monitoring
Dipl.-Ing. B. Keser1*, Dr.-Ing. T. Mietzel1, Dr.-Ing. L. Rieger2

1 Universität Duisburg-Essen, Campus Essen, Fakultät für Ingenieurwissenschaften, Abteilung Bauwissenschaften, Fachgebiet Siedlungswasser- und Abfallwirtschaft, Universitätsstraße 15, 45141 Essen
2 Groupe de recherche en génie des eaux, Pavillon Adrien-Pouliot, Université Laval, Québec (Québec), Canada, G1K 7P4

*Corresponding author, e-mail benjamin.keser@stud.uni-due.de

Abstract

During the past years a trend towards online-analyzers can be observed, leading to a significant increase in the total amount of measurements. The problem with the currently used online-analyzers is that they are not able to give information about the measurement quality. Therefore grab sample are still taken and analyzed in the laboratory to check for the quality of the measurements. Online-analyzers are also not able to give sufficient information about their current state. This often leads to unexpected shutdowns and to an increase of maintenance effort and costs.

To improve the measurement quality of online-analyzer more information about the processes within the analyzer’s system and more signals are needed. The output of most online-analyzer is only one signal, sending the measured concentration. Therefore a phosphorus online-analyzer was examined to study the already available signals and to search for a way to improve the evaluation of these signals. During the measurement of one concentration the analyzer creates a frequency curve with approximately 600 individual measurements which are not shown. The analyzer only uses 10 individual measurements to calculate the concentration. During the experimental period the reaction of the frequency curve on intentionally triggered failures was examined to find typical patterns for the faults. The three modes that the analyzer runs in and the used spare parts were examined too. With the information about the existing capabilities of the analyzer and with the additional information that was gained through the experiments a concept was developed to point out the failure causing part. With the development of a matlab based program a tool was developed that follows the frequency curve and checks whether the curve takes a normal course or not. Further, with the program an optimization of the time that is needed for the measurement is possible.

With the results of the experiments and with the knowledge about the analyzers abilities a sensor self-diagnosis concept has been developed. If the analyzer detects a failure, state of the art still is a warning message that signalizes a problem somewhere within the system, not specifying any detail. With the sensor self-diagnosis concept a step towards detection, isolation and identification of the failure was made. The concept also led to an increase of the number of detectable malfunctions. To reduce the cost and the effort, spent on maintaining online-analyzers a dynamic maintenance concept was developed. In this concept the static maintenance cycles were reduced to a minimum and a dynamic maintenance manager was implemented to optimize the maintenance cycles.

Both concepts were then combined to a “pro-active” maintenance concept. The assembly of the two concepts allows an increase of detectable errors and a detection of malfunctions before the data quality decreases. In this concept first automatic maintenance actions will be triggered to remove a failure. If the automatic action does not succeed the dynamic maintenance manager will demand for manual maintenance.