

CHALLENGE

Industrial companies often release high loads of wastewater to the municipal sewage network. When releases are unannounced or unexpected, they may seriously harm treatment processes and even lead to their breakdown at municipal wastewater treatment plants (WWTP). Process repair involves high costs. Therefore, control, quick evaluation of treatment processes, and information flow between industry and the municipal treatment plant is a big challenge.

SOLUTION: INSTRUMENTATION, CONTROL AND AUTOMATION

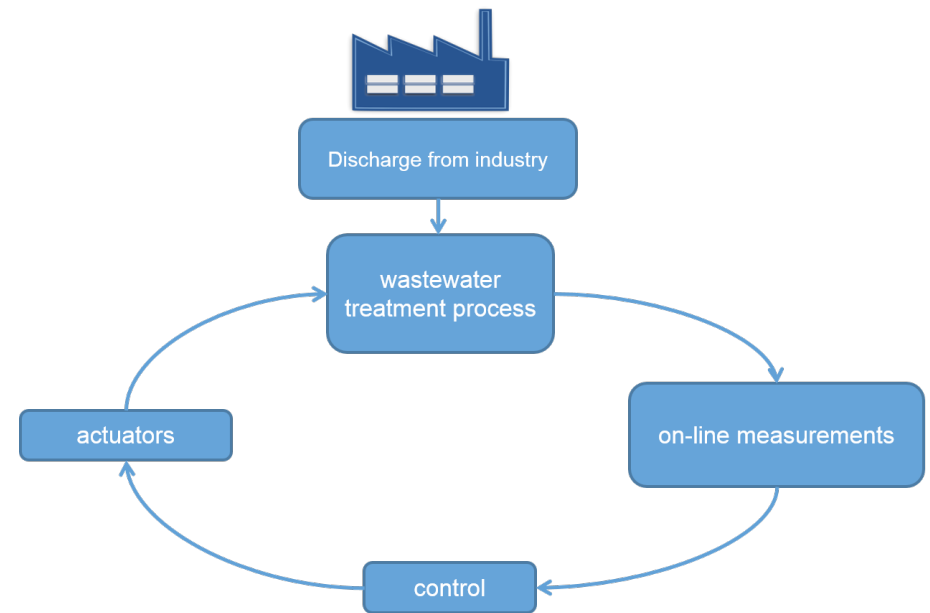
Nowadays, automatic instrumentation plays an important role both at municipal and industrial WWTPs. In order to avoid long lasting analytical analysis, the measurement should be carried out onsite, thereby providing quick response and enabling the process to be controlled as quickly as possible.

Instrumentation, Control and Automation (ICA) is a key technology to keep the WWTP working as efficiently as possible despite disturbances. The task of ICA is to provide information on the current state of the wastewater treatment process. ICA also helps to monitor the status of the equipment and helps to make decisions based on the collected information.

PRINCIPLE OF OPERATION

An automation systems consist of sensors gathering information, actuators managing the system, and controllers. At a basic level, ICA is applied to keep the plant running by automatically manipulating the actuators, i.e. the pumps, valves and compressors, in order to keep physical variables, such as flow rates, levels and pressures, around the desired values. Once this is guaranteed, at the second level, the effluent or "product" quality requirements must be satisfied. Computers are used to remotely monitor and control WWTPs and to archive the data. The complexity of the automation system depends on the size of the WWTP. In small WWTPs, systems are usually less complex, however, in some cases, even a small WWTP may need a more sophisticated automation system. ICA has a major positive impact on the performance of the wastewater treatment plant by regulating the wastewater treatment process.

Scheme of ICA feedback principle



Even simple application of on-line instrument can significantly improve the control of treatment of industrial wastewater, its discharge to sewerage system, and its influence on municipal wastewater treatment processes

ADVANTAGES and LIMITATIONS

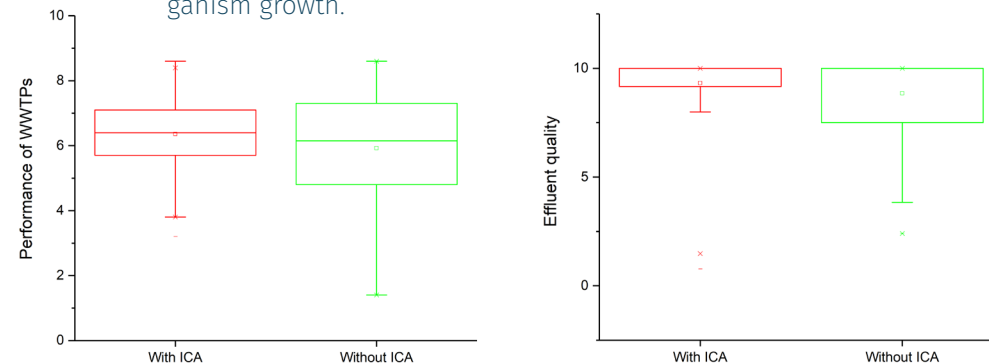
Application of such ICA strengthens communication and cooperation between industry and municipal WWTP. It lets for better control of unexpected leakages/discharges from industry to municipal sewerage network and thus protects treatment processes at municipal WWTP and finally prevents from excessive loads to the environment from plant effluents.

Automation helps to ensure that the effluent is consistently of good quality. Sometimes, however, the positive effect of remote monitoring may not be perceptible at every time. When the problem arises, the remote control system will alert the operator but will not always automatically solve the problem. ICA is a key technology to keep a plant or a process working as efficiently as possible despite disturbances. This includes saving energy and resources.

EXAMPLE

An automatic control of dissolved oxygen (DO) content in wastewater serves as an example. Assuming good and regular maintenance of the DO sensors the following positive results can be expected:

- A **lower risk of oxygen deficiency** in the activated sludge process;
- **Quick response** for sudden changes in the oxygen demand;
- Better control of blowers operation and resulting **energy savings**;
- Records of wastewater temperature (as part of DO sensors) in a process tank, which in turn allows the operator to **control the SRT** (Solids Retention Time) in accordance with the kinetics of microorganism growth.



WWTP performance was evaluated by measuring differing critical control points for WWTP functioning

66.7 % of WWTPs studied in Estonia [1] are using ICA for the process control. Statistical analyses showed that in WWTPs where ICA was used there was a significant improvement in plant's performance and effluent quality (presented on the scale of 10p).

[1] Kõrgmaa, V. et al. 2016 Evaluation of treatment efficiency of wastewater treatment plants, constructed and reconstructed in 2004-2014, <https://www.envir.ee/sites/default/files/aruanne.pdf>