AQUARES Project - study visit presenting innovative technologies of water treatment, recovery and monitoring in the łódzkie voivodeship

Water scarcity has become increasingly severe in recent decades and demand for water continues to grow. EU Member States are looking for solutions to improve water quality and reuse. One of the main objectives of the AQUARES project, implemented under the Interreg Europe programme, is the exchange of knowledge in the field of efficient water management between the project partners and the recognition of specific technological solutions to improve the water balance in the EU countries.

On 16 and 17 October 2019, experts from the AQUARES project partnership countries, i.e. Spain, Czech Republic, Malta, Latvia, Slovenia, Italy and Germany, learned about innovative water treatment technologies implemented in the łódzkie voivodeship. At the beginning, Dr. Sebastian Szklarek from the European Regional Centre for Ecohydrology of the Polish Academy of Sciences presented the hydrological characteristics of the region.

On the first day of the study visit, the participants visited the Municipal Water and Sewage Treatment Plant in Sieradz and the "Biliński" Textile Factory in Konstantynow Lodzki.

Treatment Plant in Sieradz provides services for the inhabitants of the Sieradz agglomeration covering the City of Sieradz and the surrounding rural areas of the Municipality of Sieradz. During two-stage treatment of water collected from sources (iron and manganese removal) using DynaSand filters, so called rinse water is created. The applied technologies purify the rinse water, separating and thickening the sludge, and the supersedimentary water is returned to the filter again. In other words, the rinse water is cleaned of dense impurities and the recovered water is returned to the treatment again. It is estimated that the technology used minimises the use of rinse water by approximately 10%. The technology used in MPWiK in Sieradz was implemented in cooperation with AWP Nordic Products Sp. z o.o. from Łódź.

The "Biliński" Textile Factory located in Konstantynow Lodz employs nearly 300 people. The plant specializes in dyeing, bleaching, finishing, as well as digital printing of fabrics and knitwear. Over 50% of sales is for export, the main direction is Scandinavian countries, although the customers are also the Baltic States and the Czech Republic, Slovakia, Germany, Great Britain and Italy.

The project of sewage treatment and closing water circuits in the "Biliński" Textile Plant was carried out on the basis of BAT (Best Available Techniques) guidelines - the best available techniques for the textile industry (European Commission, 2003).

The BAT guidelines provided for the following stages of work:
1. characterization and division of sewage into streams in terms of their biodegradability,
2. design of a treatment system for the relevant waste water streams,
3. examine the possibility of using treated water for production processes.

The plant distinguished two main streams of wastewater:
1. wastewater susceptible to biological treatment,
2. non-biodegradable waste water destined for chemical wastewater treatment plants.

Low-loaded sewage (so called rinse water) is directed to biological treatment. The water is treated to a minimum, technologically acceptable level of purity and reused in production processes. Thanks to this, about 40-50% of water intake is reused. Wastewater which is not suitable for reuse, i.e. which could cause adverse effects on the biological treatment plant, is also treated with the coagulation method and flocculation, and then directed to the sewerage system. The latest project of the company is based on the separation of colored sewage, characterized by high salinity (salt content

reaching 80g/ml), very high pH, strongly colored (impervious to light). After applying appropriate physico-chemical methods, the wastewater is treated to such an extent that it can be reused for staining.

The second day of the study visit began at the Training and Conference Centre of the University of Łódź at 26 Rogowska Street, where Adam Kaźmierczak, Director of the Technology Transfer Centre of the University of Łódź and Prof. Maciej Bartos, Deputy Dean of the Faculty of Biology and Environmental Protection of the University of Łódź, presented to the participants the activities of the University of Łódź in the area of innovations and ecology.

Then, Dr. Tomasz Jurczak introduced the guests with the project "Ecohydrological reclamation of recreational reservoirs Arturówek in Łódź as a model approach to urban reservoirs reclamation (EH-REK)".

The activities implemented within the project limit the inflow of pollutants from the municipal catchment area to water reservoirs and the Bzura River. The principle of their operation is the concept of a sequential sedimentation and biotransfer system (SSSB). The system consists of three zones:

1. a sedimentation system, in which the flow of water is slowed down, as a result of which a significant part of the transported suspension is stopped,
2. biogeochemical, where phosphorus compounds dissolved in water are reduced through the use of dolomite-lime structure,
3. biological - using phytoremediation processes to reduce nitrogen compounds dissolved in water.

The solutions applied in Arturówek on the upper reservoir not only have a positive impact on water quality, but also improve biodiversity and provide habitats for living organisms.

Another place for the study visit was the Academic Sports and Didactic Centre of the Lodz University of Technology Sport Bay. The technologies used in the Sports Bay were presented to the participants of the study visit by Przemysław Solarek, Deputy Director for the Facility. Re-use of water in swimming pools consists in the operation of overflows in a closed circuit. Both swimming pools in the Sports Bay are equipped with overflow gutters, by means of which splashed water goes to the tank in the underbasin. These tanks are covered to avoid evaporation. Water circulating in a closed circuit is subjected to disinfection and filtration. For this purpose, pressure filters are used, consisting of about 200 candles. Water enters the filter under pressure and is filtered through diatomaceous earth, which is saturated with material around the "snail" of the filter. Chlorine is added to the water treated in this way, which is produced on site in an electrolyzer. NaCl salt forms a salt arc and chlorine in the form of gas, which is much more efficient than liquid chlorine. The water then flows through the UV lamp. The photo-oxidative disinfection lamp effectively neutralizes bacteria, viruses and other microorganisms and blocks their multiplication. Then the water returns to the pool with a system of pipes and bottom jets (in the amount of nearly 100). Within 1 day it can be estimated that in a swimming pool with a total volume of 3 300 m3 water is replaced on average three to four times. Monitoring of the quality of pool water is carried out continuously.

The final part of the study visit to the łódzkie voivodship was the presentations of Cybercom Poland Sp. z o.o., Prof. Andrzej Jodłowski from the Faculty of Construction, Architecture and Environmental Engineering of the Lodz University of Technology, Jacopo Foschi and Riccardo Delli Compagni - researchers from Politecnico di Milano.

Aleksander Sokalszczuk from Cybercom presented the PoC (proof of concept) project of a solution used for ongoing monitoring of water condition in the network thanks to measurements made in many places, providing uninterrupted information on the occurrence of conditions conducive to the development of E. coli bacteria. The solution of the Łódź company is a response to the problem of lack of current information about the quality of water in the network, which results from the long waiting time for the results of manual measurements (an average of one day between sampling and testing) and the small number of measurement points.

The technological solution designed by Cybercom is based on a set of sensors: temperature, pH, water clarity, flow and smell (ultrasounds are used here, which allow the system to assess the smell of water - there are no sensors to assess the smell of liquid substances). Additionally, the system is equipped with a WiFi module, thanks to which all information about the quality of the tested water is recorded in the cloud.

The next AQUARES study visit will take place in the Pardubice Region (Czech Republic).

For more information on the AQUARES project, please visit:
https://www.interregeurope.eu/aquares/