LIFE2Water

Ověření a vyhodnocení technologií pro terciární dočištění komunálních odpadních vod

AFTER-LIFE COMMUNICATION PLAN

LIFE13 ENV/CZ/000475

DELIVERABLE E3D1 OF LIFE2WATER PROJECT

SEPTEMBER 2017

www.life2water.cz

AQUA PROCON

Brněnské vodárny a kanalizace a.s.

ALS

1. RESULTS ACHIEVED

Water pollution is still a serious environmental problem. Organic pollution, nutrients, pathogenic organisms and other substances with negative effects on organisms are discharged with treated wastewater. Wastewater treatment plants play a key role in water protection. Almost all biological pollution is removed during mechanical-biological treatment; nitrogen and phosphorus concentrations are significantly reduced. Pollution loads of pathogens and chemical pollution such as pharmaceuticals and their metabolites, personal care products, pesticides and other industrial compounds remain high due to a lack of adequate treatment methods. Chemical pollution represents a significant risk to water environment such as acute and chronic toxicity for aquatic organisms, influence on their reproduction and behaviour, accumulation in ecosystems, loss of habitats and biodiversity, as well as threads to public health. Regarding the growing concentration of chemical pollution in waters it is important to solve the problem at wastewater treatment plans implementing adequate treatment methods.

LIFE2Water project is a reaction to the need to improve water quality of discharged municipal wastewaters co-financed from LIFE+ programme, EU's financial instrument. Project LIFE2Water aims to improve the quality of discharged wastewater effluents by implementation of innovative technologies for tertiary treatment of municipal wastewater and their verification on pilot scale. Pollution removal efficiencies (microbiological pollution, pollution by selected chemical compounds) and operational parameters (consumption of electric energy and other inputs) were monitored and evaluated during project implementation. Guidelines on selection of the technology for tertiary treatment of municipal wastewater was prepared. The guidelines are usable for water operators and designers. Project and design company AQUA PROCON s.r.o. (AQP) is a coordinating beneficiary, water company Brněnské vodárny a kanalizace, a.s. (BVK) and analytical laboratory ALS Czech Republic, s.r.o. (ALS) are associated beneficiaries. Project was executed from September 2014 to December 2017.

PILOT UNITS

Three pilot plants were designed and constructed: (1) pilot plant of micro-strainer filtration in combination with UV radiation and dosing hydrogen peroxide, (2) pilot plant of ozone sonolysis and (3) pilot ultrafiltration plant with coagulation and adsorption on active carbon. Each of the plant was operated at the Wastewater treatment plant Brno-Modřice in real operating conditions for one year. The capacity of pilot plants corresponded to wastewater treatment plants of a capacity of 400 to 3 000 population equivalent.

POLLUTION MONITORED AND ANALYTIC METHODS USED

Expect for the basic water quality parameters, microbiological pollution (fecal coliform bacteria, enterococci and *Escherichia coli*) and selected chemical compounds were among the parameters monitored. Selected chemical compounds comprised of pesticides (in total 26 pesticides and their metabolites were monitored with atrazine ant its metabolites, MCPA, MCPP, MCPB among them), selected industrial compounds (nonylphenols and bisphenol A), selected pharmaceuticals (in total 23 with diclofenac, carbamazepine, naproxen, X-ray contrast media and antibiotics among them) and steroid hormones (17α-ethynyl estradiol, 17β-estradiol and others).

Modern instrumentation consisting of liquid chromatography with tandem mass spectrometry was used for detection and quantification of pollutants concentrations in wastewater samples. These analyses enable to determine an array of compounds even in very low concentrations.

POLLUTION REMOVAL EFFICIENCIES AND OPERATIONAL COSTS OF THE TREATMENT

Regarding basic water quality parameters total phosphorus is removed from one third and suspended solids are removed nearly from 50 % in the pilot plant of micro-strainer filtration in combination with UV radiation and dosing hydrogen peroxide. Removal efficiencies of COD, BOD and total nitrogen are without significant changes. In the pilot plant of ozone sonolysis BOD is significantly increased nearly two times, COD is removed slightly and suspended solids are removed to nearly one half. Total phosphorus and total nitrogen are not removed. In the pilot ultrafiltration plant with coagulation and adsorption on active carbon all suspended solids are removed; COD, BOD and total phosphorus is removed significantly. Removal efficiency of total nitrogen is without significant changes.

Removal efficiencies of selected microbial parameters ranges between 64 % and 100 % in the pilot plant of micro-strainer filtration in combination with UV radiation and dosing hydrogen peroxide. The highest removal efficiency is achieved by solely use of UV radiation, the removal efficiency is from 87 to 92 %. Removal efficiencies of microbial pollution is nearly 100 % in the pilot plant of ozone sonolysis and 100 % in the pilot ultrafiltration plant with coagulation and adsorption on active carbon.

Removal efficiencies of selected chemical compounds – industrial compounds, pesticides and pharmaceuticals – are low in the in the pilot plant of micro-strainer filtration in combination with UV radiation and dosing hydrogen peroxide. Depending on the operating conditions individual pharmaceuticals are removed up to 50 %. Removal efficiencies of selected chemical compounds depends on the ozone dose (industrial compounds and pharmaceuticals except for X-ray contrast media are removed under the detection limits). Removal efficiencies of selected pesticides and their metabolites are similar expect for the metabolites of atrazine. These are not possible to removed even at the highest ozone doses. Removal efficiencies of selected chemical compounds are significant in the pilot ultrafiltration plant with coagulation and adsorption on active carbon, selected pesticides and pharmaceutical are removed from nearly 80 % and 93 %, respectively. However, it is essential to avoid secondary contamination of the treated water by bisphenol A caused by the membrane module.

Significant differences among pollution removal efficiencies and operational requirements of the pilot units are reflected in the costs of treatment. If focussing on removal of microbial pollution only, a pilot plant of micro-strainer filtration in combination with UV radiation and dosing hydrogen peroxide with operational costs starting from 1.02 Kč·m^{-3} is suitable for this use. Quality of service water is possible to achieve in pilot plant of micro-strainer filtration in combination with UV radiation and dosing hydrogen peroxide at UV dose 3300 J·m^{-2} with operational cost 3.53 CZK·m^{-3}. Similar results is possible to achieve in pilot plant of ozone sonolysis at the ozone dose 5 mg·l^{-1} O_3 and ultrasound dose 625 J·m^{-3} or at the ozone dose 5 mg·l^{-1} O_3 and 2 mg·l^{-1} H_2O_2 with operational cost 1.60 CZK·m^{-3}, respectively 1.29 CZK·m^{-3}. Moreover, approximately 95 % of bisphenol A, 68 % of pesticide active substances and 73 % of pharmaceuticals are removed.

PROJECT TARGER GROUPS AND IMPACT OF DISSEMINATION ACTIVITIES ON THESE GROUPS

(1) Water management experts (water infrastructure owners, water companies, designers of water infrastructure, state administration and self-government bodies responsible for water management).

The project supported best practice examples v the field of wastewater treatment. Seminars and excursions were organised for experts. Information about the project and its results were presented at conferences and published in expert journals. Project results were also presented on project website.

(2) Lay public

Lay public perceives water pollution as one of the major environmental problem. The activities for lay public aimed at promotion of water protection. Excursions, articles to journals and leaflet were prepared for lay public. Project results were also presented on project website.

2. AFTER-LIFE COMMUNICATION PLAN

2.1 DISSEMINATION ACTIVITIES IMPLEMENTED

- A logo of the project and the corporate design were created. The style and the logo together with the logo of the LIFE programme were used for presentation of the results and during the dissemination activities.
- Notice boards were produced. The boards were placed at beneficiaries' headquarters and at the wastewater treatment plant Brno-Modřice.
- Project website was launched (www.life2water.cz) and is available in Czech and English. It contains information about the project, project deliverables and news. Project website is an important tool for communication with target audience and other stakeholders. Project website are in Czech and English.
- Leaflets for broad public and experts were created and were distributed among the both target groups during the dissemination activities. Electronic versions of the leaflets were uploaded to project website.
- Project and its results was regularly presented at various conferences in the Czech Republic and Slovakia.
- The excursions to wastewater treatment plant Brno-Modřice were organised for lay public to increase the awareness among and to promote project results.
- Four seminars for expert were organised. At seminars, project LIFE2Water and its results were presented. Excursions to laboratories and to pilot location were part of the seminars.
- Articles do various magazines were prepared. Lay public and experts were the target groups.
- In cooperation with other organisations, a number of activities were prepared to promote LIFE programme and LIFE2Water project (for example presentation at

fairs and seminars organised by National Contact Point of The Ministry of Environment).

2.2 ACTIVITIES PLANNED AFTER THE PROJECT END

- Excursion to the pilot locality for representatives of European Union.

  In cooperation with external monitoring team NEEMO an excursion to the pilot locality Brno-Modřice will be organised on 31 May 2018 for external monitors of LIFE programme, representatives of the European Union and EASME within the Horizontal meeting of LIFE programme. A tour through the wastewater treatment plant will be part of the excursion.

  Beneficiaries responsible for the activity: BVK, AQP.

  Implementation: first half of 2018.

- Cooperation with National Contact Point (NCP) of The Ministry of Environment.

  Project beneficiaries will cooperate with NCP on promotion of the LIFE2Water project and LIFE programme. Presentation of the project and its results eventually excursions to pilot locality will be organised upon request.

  Beneficiary responsible for the activity: AQP.

  Implementation: 2018-2019. Cooperation with NCP may be extended.

- Distribution of dissemination materials.

  Project beneficiaries will distribute dissemination materials during dissemination events (leaflet for lay public and leaflet for experts, laymen's report). Materials will be reprinted if needed.

  Beneficiaries responsible for the activity: AQP, ALS, BVK.

  Implementation: 2018-2022. Reprint of dissemination materials if needed.

- Project website.

  Project website (www.life2water.cz) available in Czech and English contains deliverables or their summaries, dissemination materials and other relevant information including links for project beneficiaries and LIFE programme. Project website will be kept and regularly updated.

  Beneficiaries responsible for the activity: AQP (webhosting, website maintenance and update), ALS and BVK (supply data).

  Implementation: 2018-2022. Update of website content regularly.

- Excursions to pilot locality and wastewater treatment plan Brno-Modřice for broad public.

  During the project execution, the issue of occurrence of chemical pollution (pesticides, pharmaceuticals) was highlighted among lay public. After the project end, beneficiary BVK will continue with organisation of excursions for lay public with emphasis on excursions for schools (primary, secondary). The aim of excursions is to raise awareness about the importance of wastewater treatment and the importance of water savings.

  Beneficiary responsible for the activity: BVK.

Implementation: 2018-2022. Expected number of excursions 40-50 a year.

- Cooperation with experts (water companies, owners of water infrastructure, designers, suppliers of services and products in water management).

  During project execution, the issue of wastewater treatment was regularly discussed in water management experts, the results achieved were widely disseminated. The cooperation with experts will continue after the project end (for example discussions at conferences and seminars, excursions to pilot locality).

  Beneficiaries responsible for the activity: AQP, ALS, BVK.

  Implementation: 2018-2022.

- Cooperation with experts (organizations that are not primarily involved in environmental protection)

  During the project execution, beneficiary ALS discussed the project results with regional public health authorities and a list of chemical compounds monitored in the South Moravian Region was prepared. Beneficiary ALS will continue and cooperate with public health authorities across the country.

  Beneficiary responsible for the activity: ALS.

  Implementation: 2018-2019. Cooperation may be extended.

- Presentation of project and its results at conferences.

  Project beneficiaries will present the project and its results at conferences in the field of water management and analytical chemistry. Emphasis will be given to foreign conferences (conferences organised by European Water Association and International Water Association).

  Beneficiaries responsible for the activity: AQP, ALS, BVK.

  Implementation: 2018-2020. Attendance to 1-2 conferences a year expected.

- Cooperation with expert commissions of SOVAK ČR (The Water Supply and Sewerage Association of the Czech Republic).

  Beneficiary BVK will use the experience and results of the project and through the expert commissions (Legal Commission, Commission of Sewerage Networks operators) will comment on legislation and norms prepared.

  Beneficiary responsible for the activity: BVK.

  Implementation: 2018-2020. Attendance to 2-3 meetings of expert groups a year expected.

- Preparation of articles to magazines and journals.

  Preparation of 2-3 articles to magazines and expert journals in the field of water management is expected. Preparation of a paper to scientific journal will be considered.

  Beneficiaries responsible for the activity: AQP, ALS, BVK.

  Implementation: 2018-2020.

- Analyses of wastewater to detect chemical pollution present.

Beneficiary BVK will sample and test wastewater effluent for presence of chemical pollution (industrial compounds, pesticides, pharmaceuticals). Testing of wastewater inflow will be considered.

Beneficiary responsible for the activity: BVK.

Implementation: 2018-2022. Number of samples and the sampling period will be based up on the need of BVK.

- Organisation of demonstrations.

  Beneficiary AQP will offer demonstrations of the technologies tested (ozone sonolysis, ultrafiltration wit coagulation and adsorption on active carbon) on non-commercial basis. AQP will use the opportunity and raise awareness about the technologies for tertiary wastewater treatment among water companies).

  Beneficiary responsible for the activity: AQP.

  Implementation: 2018-2022. Organisation of 1-2 demonstrations expected.

- Development and accreditation of methods for monitoring of transport of chemical pollution in the environment.

  Methods for detection of selected chemical pollution (pesticides, pharmaceuticals, industrial compounds) in treated wastewater were developed by ALS during the project. These methods were also developed and accredited for other matrices (sludge and sediments). Currently methods for detection of chemical pollution in wastewater inflow are being developed by ALS. Together with new legislation adopted, other chemical compounds will be added to these methods.

  Beneficiary responsible for the activity: ALS.

  Implementation: 2018-2020.

- Preparation of project proposals.

  Project beneficiaries will continue in cooperation with various organisations and will prepare project proposals in the field of water management to be submitted to various European and national funding schemes.

  Beneficiaries responsible for the activity: AQP, ALS, BVK.

  Implementation: 2018-2022. Preparation of 2-3 proposals a year expected.