Interreg
CENTRAL EUROPE
European Union
European Regional
Development Fund

boDEREC-CE

BOARD FOR DETECTION AND ASSESSMENT OF PHARMACEUTCAL DRUG RESIDUES IN DRINKING WATER - CAPACITY BUILDING FOR WATER MANAGEMENT IN CE

Newsletter 02 September 2020

FACTS & FIGURES

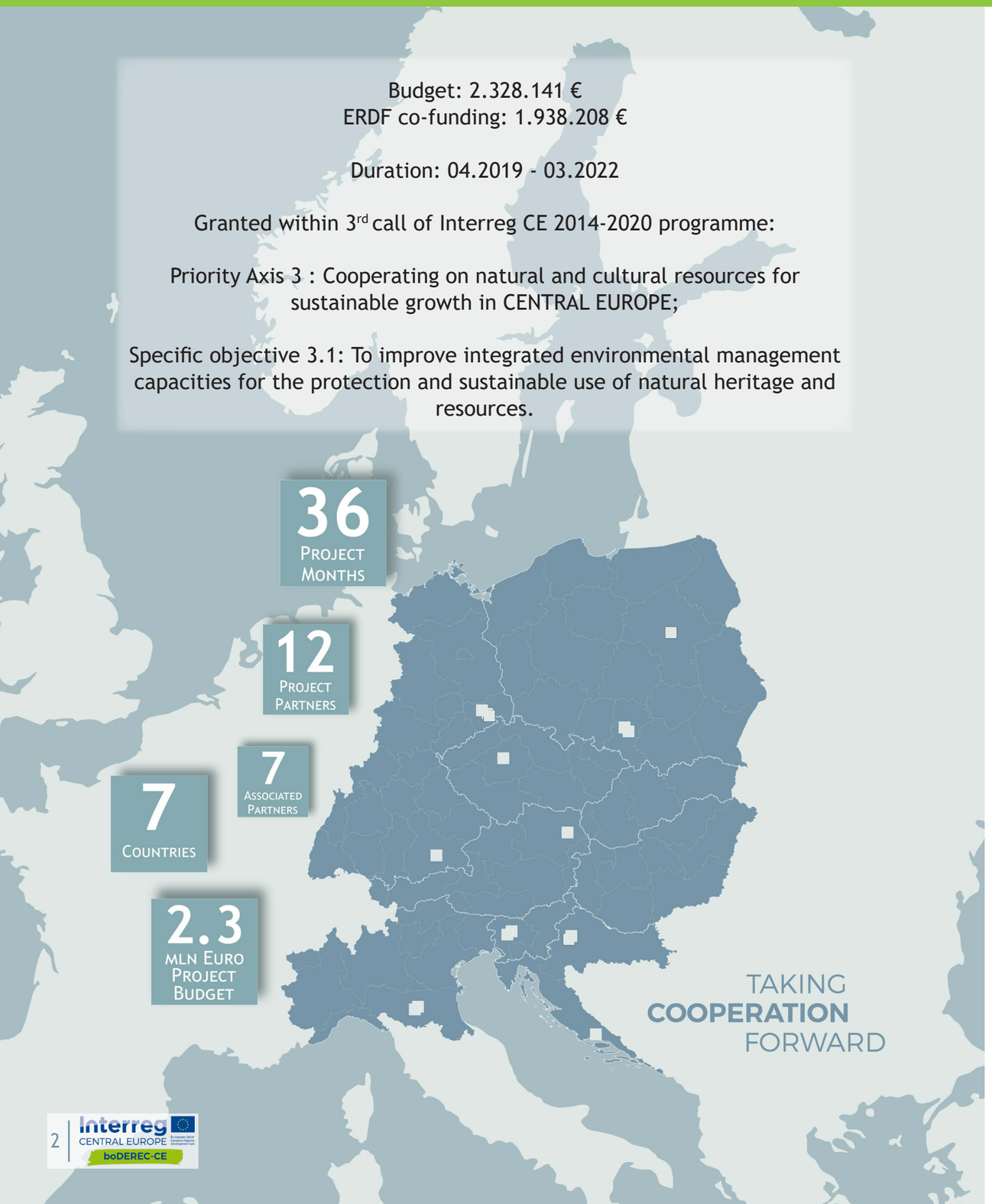
Budget: 2.328.141 €
ERDF co-funding: 1.938.208 €

Duration: 04.2019 - 03.2022

Granted within 3rd call of Interreg CE 2014-2020 programme:

Priority Axis 3 : Cooperating on natural and cultural resources for sustainable growth in CENTRAL EUROPE;

Specific objective 3.1: To improve integrated environmental management capacities for the protection and sustainable use of natural heritage and resources.



MOTIVATION AND MAIN OBJECTIVES

NEW WATER CONTAMINANTS - CURRENT PROBLEM FOR DRINKING WATER MANAGEMENT

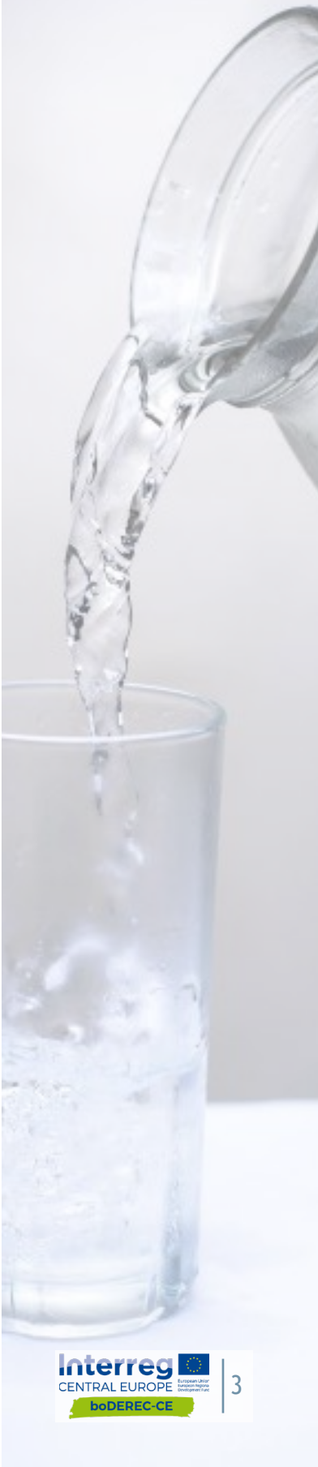
Water is one of the most valuable raw materials for today's civilization and one of the most important factors that determine the quality of our lives. Technological development, on the one hand, plays a significant role in various forms of environmental pollution, and hence for water. On the other hand, scientific development can detect and combat these risks. This includes monitoring of the occurrence of recently unknown forms of contamination caused by micropollutants. Recent research shows that the aquatic environment, from which we produce potable water in Europe, contains anthropogenic substances - until a few years ago, their presence was unknown and there are still considerable knowledge gaps.

SPECIFIC OBJECTIVES

- STUDIES ON PPCPs IN THE NATURAL ENVIRONMENT
- EVALUATION OF THE TECHNOLOGICAL ASPECTS OF PPCP ATTENUATION IN DRINKING WATER
- ESTABLISHING OF DECISION SUPPORT SYSTEM FOR WATERWORKS

MAIN OBJECTIVE

DEFINITION OF AN INTEGRATED MANAGEMENT STRATEGY FOR WATERWORKS THAT GUARANTEES INCREASED QUALITY OF DRINKING WATER



PILOT ACTION AREAS

One of the main aspect of the Interreg CE projects is conducting activities within, so-called, Pilot Actions, where tools established within the project lifetime should be tested and implemented. In the boDEREC-CE partners investigate behaviour of the PPCP substances in water implementing activities within selected Pilot Action Areas.

To cover whole palette of possible water resources, representative for the majority of water resources exploited for freshwater supply in Central Europe, boDEREC-CE partnership selected 8 pilot action areas and grouped them into 3 clusters according to their specific environmental character. Then within Pilot Action Areas boDEREC-CE partnership takes two group of activities: monitoring and modelling – application of the modePROCON tool.

PILOT ACTION CLUSTER 1

Surface water:

KOZŁOWA GÓRA, UPPER SILESIA INDUSTRIAL REGION, POLAND

PO RIVER BASIN, ITALY

DRESDEN - HOSTERWITZ, GERMANY

PILOT ACTION CLUSTER 2

Groundwater:

KARANY-JIZERA, CZECH REPUBLIC

LJUBLJANSKO KOTLINA, SLOVENIA

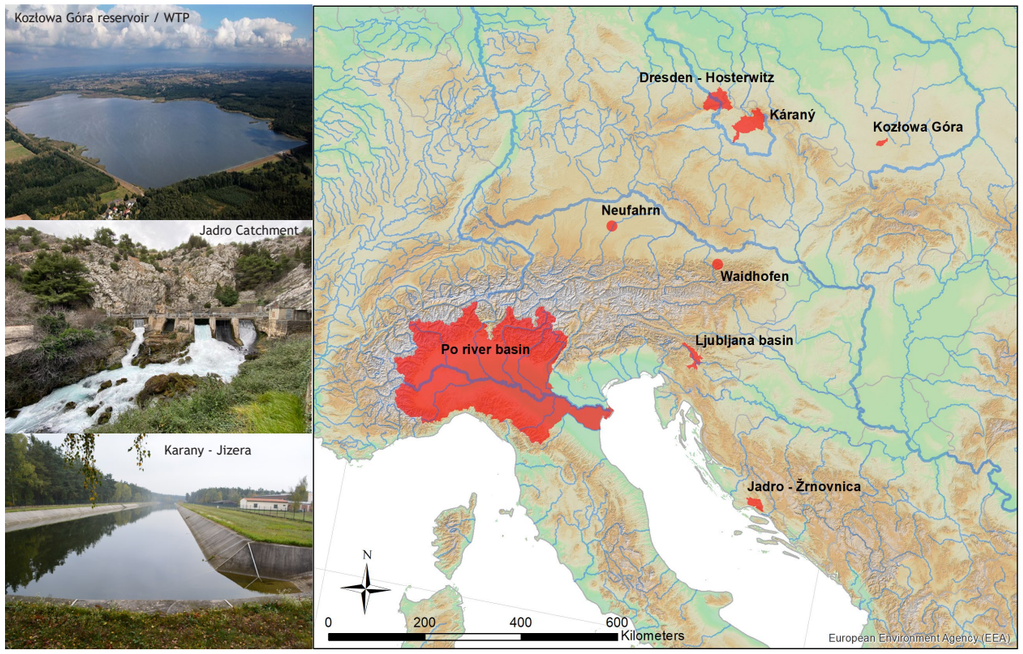
NEUFAHRN MUNCHEN, GERMANY

PILOT ACTION CLUSTER 3

Karst water:

JADRO CATCHMENT, CROATIA

WAIDHOFEN/YBBS, AUSTRIA



boDEREC-CE pilot action areas map. *David Rozman, PP03, CULS*

MONITORING CONCEPT

boDEREC-CE regular monitoring of the pharmaceuticals and personal care products (PPCP) content in water resources is carrying out. The project assumes two-year long monitoring tracking spatial changes and dilution effects and also concentration changes at particular stages of water production.

The information obtained will be used to assess attenuation in the natural environment and the effectiveness of different water treatment technologies. More than 100 substances of pharmaceuticals and personal care products are monitored regularly on 8 pilot action areas.

boDEREC-CE team has started to conduct the monitoring in September 2019 with screening serie. Then, in mid-2020, we started regular monitoring which lasts till the end of 2021.

PILOT ACTION
JADRO CATCHMENT

PILOT ACTION
JADRO CATCHMENT

The typical Dinaric karstic catchment of Jadro and Žrnovnica springs (250-500 km^2) is located in the middle part of southern Croatia, in a mountain-hilly area that stretches to the coast and is characterized by dynamic and complex hydrogeology and geomorphology. Jadro (4.5 km in length) and Žrnovnica (4.8 km in length) are karstic rivers which receive water through karstified underground and surface water inflow from the surrounding catchment area. Due to the highly karstified area, and generally thin or completely absent surface protective layers, the groundwater-surface water interchange is fairly quick. The water supply system of Split city and its wider surroundings depends on the water intake at Jadro spring. In contrast, due to the lower discharge of Žrnovnica spring during summer months, the water is used only for the water supply of the nearby Žrnovnica settlement and for irrigation of surrounding agricultural land. In the course of boDEREC-CE project, experts from the Department of Hydrogeology and Engineering geology of the Croatian Geological Survey, will conduct hydrogeological field research on spring, groundwater (borehole) and surface water for analyses of emerging contaminants (EC), stable isotopes and major ions, including in situ field measurements of physio-chemical parameters. The aim of pilot activities is to identify the main EC from the group of PPCP, their behaviour and fate in different hydrological conditions, but also to gain better insight into the complex hydrogeological properties of this karstic catchment, consequently helping to improve the protection of drinking water resources and thus human health. Monitoring data gathered through project activities will be an input for testing of model which will help to develop an implementation strategy of a model-based decisiom-making tool for EC called “modePROCON”.

LP, HGI - CGS, Pilot Action responsible

PILOT ACTION

KARANY - JIZERA RIVER

PILOT ACTION

KARANY - JIZERA RIVER

Karany Waterworks uses water from the lower reaches of Jizera River. The length of the river is 164.6 km and the catchment area is 2193 km^2. Average flow rate in Mladá Boleslav is of around 20 m^3/s. The river basin has a mixed nature with a balanced representation of forests and farmland. The only major industrial site is Mladá Boleslav, which has approximately 44,000 inhabitants.

In terms of potential sources of pollution by PPCPs, the greatest risk is the Kosmonosy psychiatric hospital in Mladá Boleslav with a 150-year tradition. Of the other cities in Jizera catchment, only four have more than 5,000 inhabitants. All sites are equipped with wastewater treatment plants.

Hydrogeologically the pilot site is characterized as a shallow unconfined aquifer situated in terraces of Quaternary fluvial sediments. The aquifer is naturally recharged by infiltration of precipitation and inflow from the bedrock. Quaternary sediment bedrock is formed by marl of large Bohemian Cretaceous basin. Marls are due to their low permeability considered as aquitard, but fractured zones allow inflows from deeper aquifers. In natural conditions groundwater from the Quaternary aquifer drains to the Jizera River. Intensive extraction of groundwater induces recharge of the aquifer from the river and in addition the aquifer is artificially recharged.

Main objective of Karany pilot site is to quantify the efficiency of different drinking water technologies in the removal of PPCP substances. The monitoring focuses on the surface water from Jizera river, which is used for drinking water production. Furthermore, the quality of drinking water produced by bank infiltration and artificial recharge will be monitored.

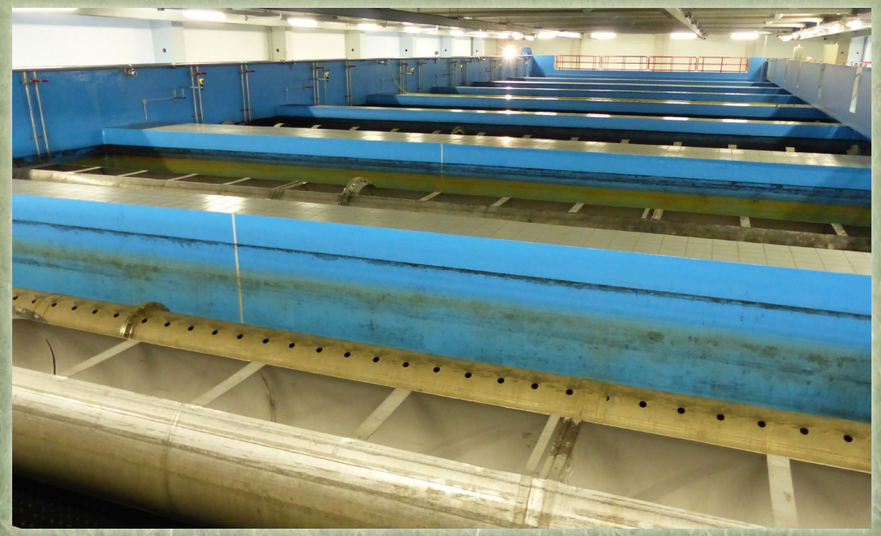
PP03, CULS, Pilot Action responsible

The riverbank filtration (RBF) and managed aquifer recharge (MAR) site Dresden-Hosterwitz is operated by the DREWAG NETZ GmbH and located on the floodplain of the Elbe River. The Elbe River is a transboundary perennial river and federal waterway. With a length of 1.097 km the Elbe River originates in the Czech Republic and flows northwest into the North Sea.

The water works operates two separate treatment trains: the RBF treatment train and the MAR treatment train. If the daily production is less than 20 000 m³, RBF will be the main treatment before cascade aeration, granular activated carbon (GAC) filtration, pH-adjustment and disinfection with chlorine. The production capacity can be increased to 72 000 m³/d through five open recharge basins supplied with pretreated Elbe River water (coagulation and open multimedia sand filtration). Water is recovered with 111 siphon wells and two separate well groups consisting of 8 and 28 wells equipped with submersible pumps.

Monitoring in the Pilot Action area is based on 5 sampling points starting from Elbe River to disinfected water to obtain information on water quality and its changes during the treatment process.

PP11, ZAFT, Pilot Action responsible



PILOT ACTION
DRESDEN - HOSTERWITZ

PILOT ACTION

WAIDHOFEN AN DER YBBS

PILOT ACTION

WAIDHOFEN AN DER YBBS

The pilot area is located 10 km south of the city of Waidhofen a.d. Ybbs in Lower Austria and is part of the eastern foothills of the Northern Calcareous Alps, with altitudes ranging from 415 to 969 m a.s.l. The area is characterized by a warm-moderate regional climate, with an annual mean temperature of 8°C and annual mean precipitation of 1379 mm (recorded at the weather station Hinterlug during the period from 1981 to 2014). The annual distribution of precipitation is bimodal with maxima during both the summer (June and July) and winter months (December and January), with snowfall dominating precipitation in the winter. Two small fluvial systems constitute the study area's drainage: the Waidhofenbach and the Lugerbach. Close to the Hieslwirt spring, the Lugerbach flows into the Waidhofenbach, which drains most of the study area into the Ybbs river in Waidhofen. (Bittner et al., 2018, Narany et al., 2019).

The geology is dominated by a lithologic sequence of dolomitic basement rocks (Main Dolomite, Triassic age). Significant sinkholes are not present in the study area, leading to the conclusion that point-infiltration plays a minor role for recharge. Moreover, prior investigations revealed that a deep karstified groundwater system exists, also below the elevation level of the Waidhofenbach valley (Hacker, 2003). Considering the specific hydrogeological setting of the area, we can assume a well-connected network of fractures and conduits. In total, the entire pilot area covers about 10 km^2. (Bittner et al., 2018, Narany et al., 2019).

5 different springs originating from the Main Dolomite are exploited by the local water works for the municipal drinking water supply of Waidhofen a.d. Ybbs, namely the Kerschbaum, Mitterlug, Hinterlug, Glashütten and Hieslwirt spring. The Kerschbaum spring has the highest mean discharge, 34 l/s, and represents the main source of freshwater. Moreover, a pumping well (Forster well) is activated during droughts to sustain the water demand of Waidhofen a.d. Ybbs. Each of the described springs is fed by karst aquifers of the Main Dolomite, where the karst system of the Hinterlug spring is separated tectonically from the two others by a pronounced strike-slip fault that separates the two mountain massifs Schnabelberg (Hinterlug spring in northern part) and Glashüttenberg (Kerschbaum, Mitterlug, Hieslwirt and Glashütten spring in southern part). Along the Waidhofenbach, several small settlements and industrial infrastructures exist, exhibiting pressure on the creek and potentially on the springs located close to it, e.g. the Kerschbaum spring.

PP12, BOKU, Pilot Action responsible

Bittner, D., Narany, T. S., Kohl, B., Disse, M., & Chiogna, G. (2018). Modeling the hydrological impact of land use change in a dolomite-dominated karst system. Journal of Hydrology, 567, 267-279.

Hacker, P., 2003. Hydrologisch-hydrogeologische Untersuchungen im Bereich des Glashüttenberges zur Frage des engeren Schutzgebietes für die Kerschbaumer-Quelle. ARC Seibersdorf research GmbH.

Narany, T. S., Bittner, D., Disse, M., & Chiogna, G. (2019). Spatial and temporal variability in hydrochemistry of a small-scale dolomite karst environment. Environmental Earth Sciences, 78(9), 273.

PILOT ACTION

LJUBLJANSKO KOTLINA

The Ljubljana basin is located in the Upper Sava basin and is the largest closed plane in Slovenia. The Sava River is a central watercourse and has its headwaters in Ljubljana Basin and then it drains to the East, passes Zagreb, Croatia and flows into the Danube River after more than 990 km in Belgrade, Serbia. The Ljubljana basin, with its central location, in which 40% of the Slovenian population lives is the most important settlement, economic and transport area in Slovenia, into which the most important roads and railway connections are joining. The Sava River has a number of tributaries that strongly influence the outflow regime of the entire area. The area is home to large aquifers with very different characteristics, ranging from intergranular to heavily karstified aquifers. These aquifers are important sources of drinking and industrial water.

There is an intensive development in the Ljubljana Basin, from the introduction of new technologies to intensive tourist activities, which are increasing year by year. At the same time, this area is becoming increasingly urbanized. All these activities increase the pressure on the environment, including the higher pressure on water resources. The intensive development has led to an increasing number of emerging contaminants affecting environment as a whole and water resources.

PP06, UL, Pilot Action responsible

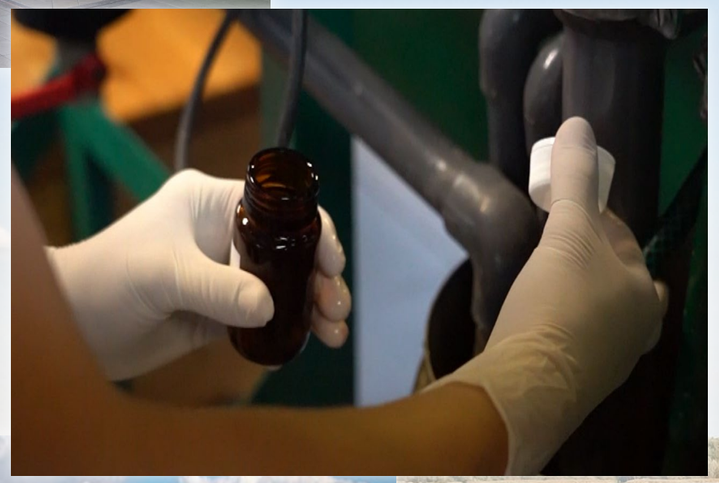
PILOT ACTION

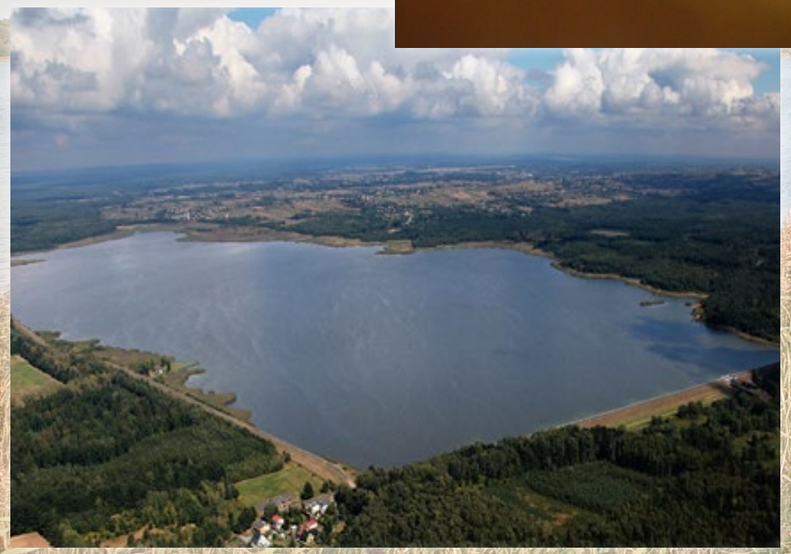
LJUBLJANSKO KOTLINA

PILOT ACTION

KOZLOWA GORA WTP

UPPER SILESIA INDUSTRIAL REGION





PILOT ACTION

KOZLOWA GORA WTP

UPPER SILESIA INDUSTRIAL REGION

After screening monitoring among 5 WTPs in use of GPW, Kozłowa Góra Water Treatment Station was seleced as a final Pilot Action area where operational monitoring is conducted. Kozłowa Góra WTP is located on the left bank of the Brynica river, directly below the bleed weir from the front barrier of the Kozłowa Góra reservoir.

Kozłowa Góra reservoir is situated in the Brynica river catchment which is a left-bank tributary of the Vistula River. The Kozłowa Góra reservoir's dam crosses the Brynica River at 28 km of the watercourse. Its catchment covers an area of 193 km^2. Within the catchment area groundwater is observed in three multi-aquifers: Quaternary, Triassic and Carboniferous. In the area three Triassic carbonate MGB are located: Gliwice, Lubliniec – Myszków and Olkusz – Zawiercie. The reservoir was built in 1935-1939 for strategic purposes. In the years 1948 - 1951 it was adapted for water supply purposes.

The reservoir dam is equipped with a bottom drain consisting of six holes - including the two left bottom sewer holes are a WTP Kozłowa Góra intake, while four other holes serve for the passage of large waters drain.

The WTP Kozłowa Góra based on following water treatment processes: pre-ozonation of raw water, contact coagulation in the fast and slow mixing chambers, rapid filtration on the anthracite-sand filers, indirect ozonation, filtration through activated carbon deposits and disinfection with sodium hypochlorite.

The objective of the monitoring is to investigate occurrence of PPCPs in the water course of Brynica River and Kozłowa Góra reservoir. Moreover, it is crucial to verify removal effectiveness of water treatment process applied on WTP (each stage of the technological process).

PP07, GPW, Pilot Action responsible

The Po river basin is an international watershed, and the largest Italian: its surface extends for about 74.000 km^2, of which about 71.000 km^2 across the Italian territory, which means a quarter of the entire national territory. The Po river is the main italian river both for length, 652 kilometers, and discharge: the maximum measured discharge has been 10.300 m^3/s in Pontelagoscuro, reached during the November 1951 flood event. The Po, whose headwaters are on the northern slope of Monviso in Piedmont, is fed by 141 tributaries along its course.

Po river basin is home to roughly 17 Mln inhabitants, and Lombardy region has the highest regional population density of the whole country (423 inh/km^2). It's an incredibly various territory: it's the most industrialised area of Italy and alluvial Po plain is intensely cultivated, with agricultural products of high quality. Transport network and infrastructures are highly developed, beside a natural environment very rich in biodiversity, due to the variations in altitude range and climate given by the Alps and the Apennines, which border respectively northern and southern edges of the Po basin.

Pontelagoscuro is a small town in the Province of Ferrara, directly on the Po river, and it represents the closure of Po hydrographic basin. Province of Ferrara has set a drinking water plant directly on the Po river, which withdraws raw waters from the Po river and groundwater.

This Pontelagoscuro drinking water plant produces about 27 000 000 m^3/y of drinking water, distributed in twelve municipalities with a network 2.500 km long. This drinking water plant is one of the very few in Italy equipped with lagooning basins, which, if needed, allow the interruption of withdrawals from the Po and guarantee three days of supply. The drinking water plant treats waters with clariflocculators, ozonation, carbon filtering, plus chlorine addition before entering the distribution network.

This plant has been chosen for monitoring activities carried out by AdbPo in the boDEREC-CE project, supported by the plant manager HERA and by Regional Agency for Prevention, Environment and Energy of Emilia-Romagna, Italy, because of its high technological level and because it withdraws waters collected from the entire basin, being at the closure of the basin, so analysis carried out on raw waters entering the plant are representative of inputs and transport processes for the entire Po basin.

In the plant, samples will be collected in different points of the treatment process, to analyse its efficiency and try to individuate best practices to improve PPCPs removal from drinking waters.

PP10, AdbPo, Pilot Action responsible

PILOT ACTION
PO RIVER BASIN

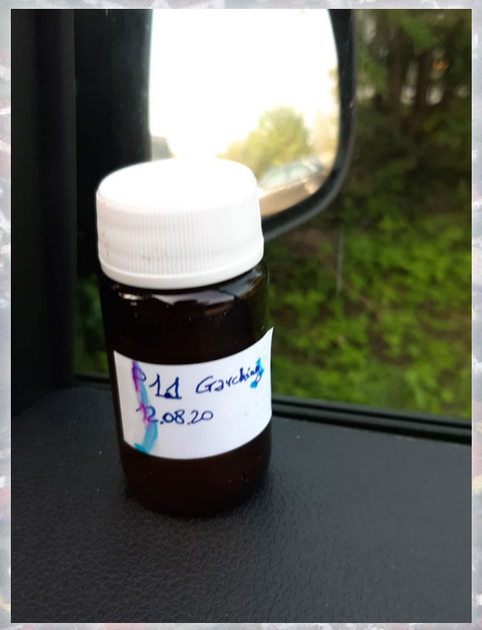
PILOT ACTION

NEUFAHRN MUNCHEN

The pilot area Neufahrn bei Freising is located about 20 km north of Munich in Bavaria and covers an area of about 48.8 km^2. The size of the area is characteristic for the Bavarian region, where a large number of small (i.e., smaller than 100 km^2) drinking water supply systems are distributed throughout the state. The drinking water protection zone of the water union Freising Süd in Neufahrn bei Freising was established in 1992 and has the primary goal to protect the well field Neufahrn from harmful impacts of anthropogenic activities. The well field comprises 3 shallow wells and 6 deep wells, whereof only the deep wells are used for the local drinking water supply. Those deep wells are screened in the hydro-stratigraphical units of the Upper Freshwater Molasse (Obere Süßwassermolasse, screened from 30 m to 80 m depth, lower aquifer). The shallow wells are screened in the Quarternary deposits (upper aquifer) and provide process water to the Garching research centre. The only river in the pilot area is the Isar river and delimits the area at its eastern boundary. Unfortunately, the Isar discharge is not gaged by the water authority in the pilot area and the closest river gages are located in Munich and Freising. Given the high hydraulic conductivity of the Quarternary aquifer, dynamic exchanges between groundwater and surface water are expected to occur in the pilot area.

For boDEREC-CE, Neufahrn bei Freising is an interesting case study since two waste water treatment plants discharge effluents into the Isar river before the upstream boundary of the pilot area. We are particularly interested to see if the dynamic exchanges between groundwater and surface water lead to any occurrence of pharmaceuticals in the water supplying wells.

PP08, TUM, Pilot Action responsible



PILOT ACTION
NEUFAHRN MUNCHEN

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