

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

NEWSLETTER 04 March 2022



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.

36
PROJECT
MONTHS

12
PROJECT
PARTNERS

7
ASSOCIATED
PARTNERS

7
COUNTRIES

2.3
MLN EURO
PROJECT
BUDGET

TAKING
COOPERATION
FORWARD

Water is one of the most valuable resources for today's civilization and the main factor that determines the quality of our lives. Nowadays we face new challenges in water resources management. One of the biggest is emerging contaminants (ECs) - newly synthesised compounds and those that are present in the environment for some time but were not perceived as detrimental to the environment and human health. Most of these substances are not included in routine water monitoring programmes. Interreg Central Europe project boDEREC-CE "Board for Detection and Assessment of Pharmaceutical Drug Residues in Drinking Water - Capacity Building for Water Management in Central Europe" recognized this as an issue that should be tackled by strong transnational cooperation of water-oriented experts and relevant stakeholders through the common course of action and policy on EU level. The boDEREC-CE project underlined a need for integrated management of waterworks and gave recommendations for the enhancement of current legislation on drinking water standards for one of the EC groups - pharmaceuticals and personal care products (PPCPs). boDEREC-CE set an innovative approach by implementing eight pilot areas across Central Europe, grouped in three clusters (groundwater, surface water, and karstic extraction sites), where behaviour of PPCPs, their natural attenuation and removal efficacy of different treatment techniques was thoroughly studied via jointly developed monitoring methodology and common project's PPCPs database. Finally, boDEREC-CE brought new tools and strategies to be implemented by waterworks operators in their daily work.

As a Lead Partner of boDEREC-CE project, Croatian Geological Survey wants to express our gratitude to all Project Partners and to the whole project consortium for fostering fruitful transnational cooperation and focusing efforts for accomplishing all project goals.

Ph.D. Josip Terzić
Head of the Department of
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boDEREC-CE Project Leader

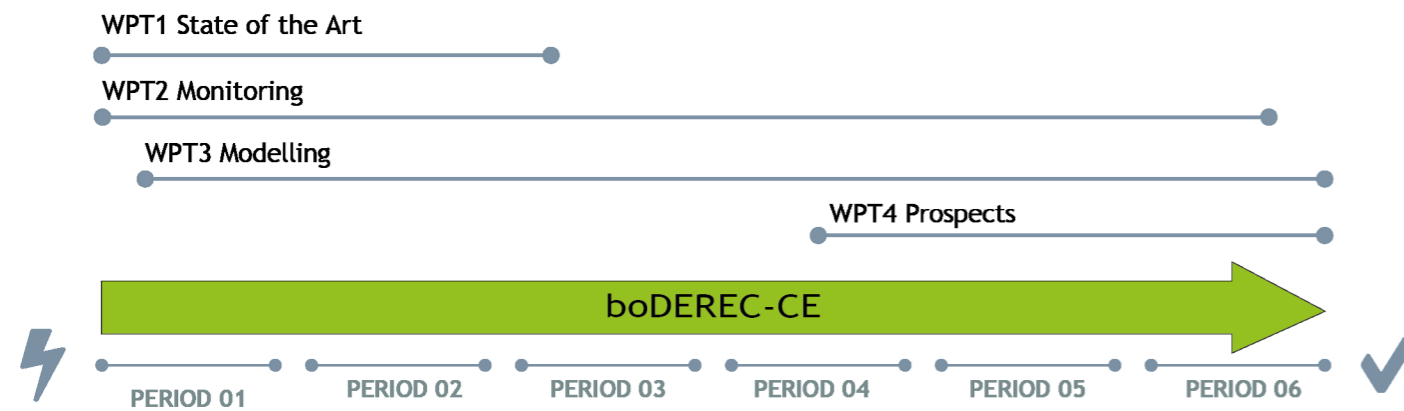


Group photo, Ljubljana, November 2019 - last team meeting in vivo.

AT THE PROJECT END

At the end of the boDEREC-CE project, we want to underline the whole effort done by the project team. 55 experts from 12 institutions from 7 countries have cooperated for 3 years on gaining new knowledge and establishing tools and

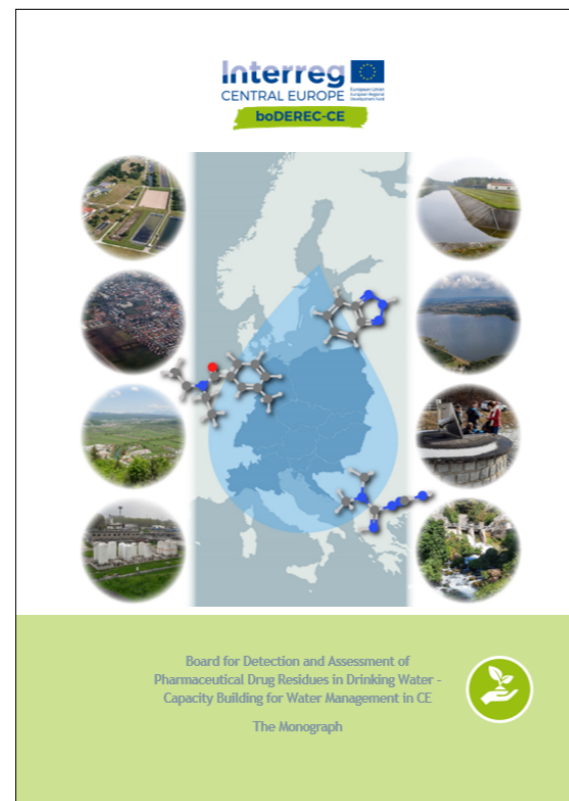
strategies for waterworks management. During the whole project lifetime, more than 180 thematic reports were prepared and more than 100 communication activities were implemented.



The timeline shows that we are at the end of the project. It is time to sum up all boDEREC-CE activities.

The boDEREC-CE project and its partners are widely available on the web - our profiles on Facebook, LinkedIn, ResearchGate are accessible. We run also a YouTube channel where several interesting videos are available, including 3 videos prepared by project partners summarising their monitoring activities. On our YouTube, there is also a promotion video available that get you closer to the project aims and realisation.

Moreover, project partners prepared the boDEREC-CE Monograph where all project activities were summarized.



WORK PACKAGE WPT1 STATE OF THE ART

The project consortium worked on WP T1 entitled "Discovering emerging contaminants in the water environment - State-of-the-art", between April 2019 and September 2020. During this period we worked on the following topics; on identifying problems related to emerging contaminants (ECs) in the environment, review on policies and legislation, on ECs appearing in the water environment, state-of-the-art in monitoring and attenuation strategies. All national (35) and transnational (7) deliverables were done on time.

The main outcomes of the WP are two outputs. The first is "State-of-the-art of

current practices in relation to emerging contaminants in the water environment" and is understood as a learning tool. It is a collection and analysis of available data from literature and other public information sources on emerging contaminants with a focus on the countries of the project partners.

The second one - Data collection tool for emerging contaminants is a tool and the review of the appearance of emerging contaminants in water environment is described and reviewed in detail.



More about the WPT1 and its realisation you can find on YouTube where presentation of prof. Mihael Brenčič from University of Ljubljana done during the boDEREC-CE Final conference is available.



3 PILOT ACTION CLUSTERS

SURFACE WATER

GROUNDWATER

KARST WATER

SUW KOZŁOWA GÓRA,
UPPER SILESIA INDUST-
RIAL REGION, POLAND

KARANY-JIZERA,
CZECH REPUBLIC

JADRO CATCHMENT,
CROATIA

PO RIVER BASIN, ITALY

LJUBLJANSKO POLJE,
SLOVENIA

Waidhofen/YBBS,
AUSTRIA

DRESDEN - HOSTERWITZ,
GERMANY

NEUFABRN MUNCHEN,
GERMANY



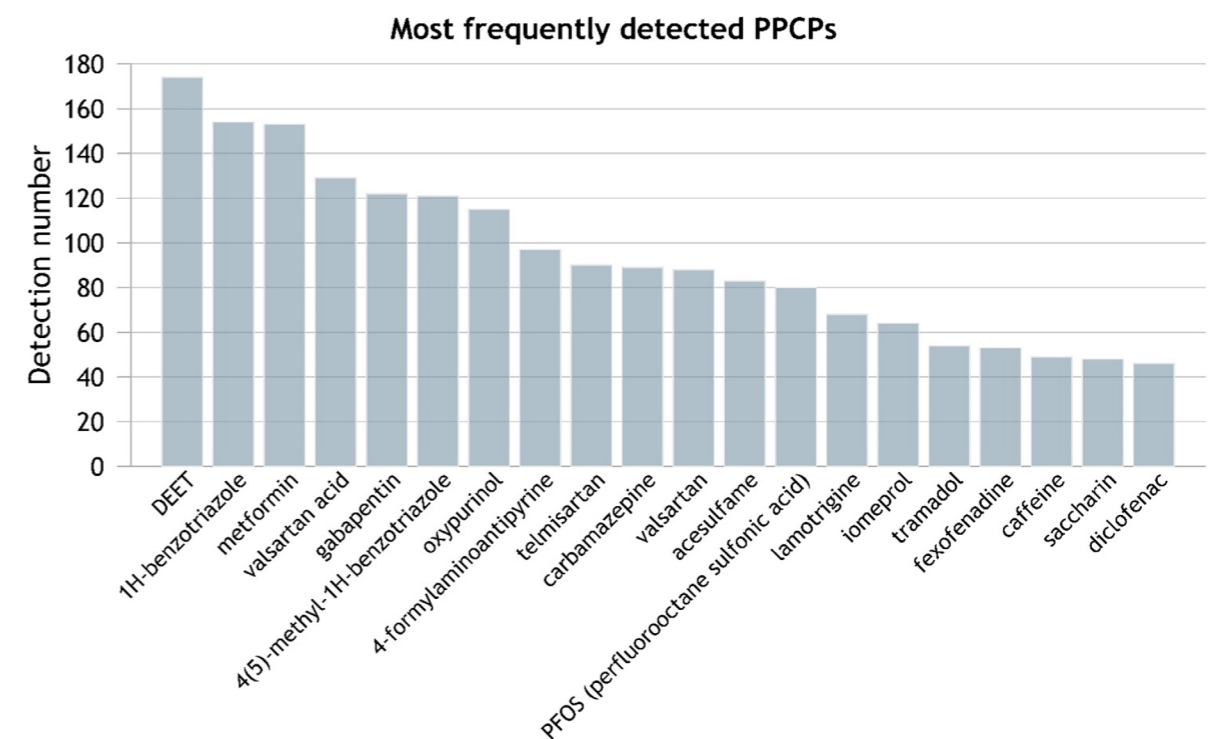
The assessment of EC behaviour in the boDEREC-CE framework is based on the data and results from eight project pilot sites situated in the Central European region. Pilot sites were divided into three clusters based on the type of water resources:

A total of 66 sites were monitored at 8 boDEREC-CE pilot sites over the period of two years. Sampling was performed mainly in quarterly intervals. All monitoring operators respected a strict sampling procedure and logistics for sample delivery to the laboratory. In total 302 samples were taken for the analysis of PPCP compounds, out of which 111 included also analysis of hormones and additional antibiotics.

surface water, groundwater, and karst aquifers.

Pilot sites are located in all partner countries and are characterized by different natural characteristics and engineering solutions for water production.

According to the results of boDEREC-CE PPCP monitoring campaigns, the insect repellent DEET is the most frequently detected compound in water resources of the CE region. DEET is also the most common substance observed, which has occurred in every pilot site. Second most common were metformin and caffeine observed in 7 pilot sites.



Detection number of 20 most frequently detected PPCPs in designated pilot areas of the CE region.

WORK PACKAGE WPT3 MODELLING

Within the framework of the WPT3 several activities were done. Firstly, to gain a transnational overview of existing country-specific frameworks for model applications in water management systems, an analysis was performed to understand how and where hydrological models are applied in the countries involved in the boDEREC-CE project. The use of models to analyse and predict the quantity and quality of water resources has become more applicable. However, the development differs between Central European countries, not only concerning the general application of models but also in terms of which models are applied.

modePROCON is a model-based decision-making tool for emerging contaminants developed to support the potential users in decision-making processes by evaluating a series of data required to perform a transport model for PPCPs detected in water sources. modePROCON has a Graphical User

Interface (GUI) developed in Python and is a standalone application, easily accessible to users. Together with the tool a Massive Open Online Course was developed to train the users for modePROCON. The course consists of nine tutorials that are available online on the boDEREC-CE YouTube Channel.

Under the identification of needs, elaboration of solutions and capacity building activities series of national stakeholder workshop were performed to establish a strong stakeholder engagement, to communicate the advantages and disadvantages of different modelling tools, and to exchange experiences and needs for the application of water resources management models. In the workshops, intersectional, interdisciplinary groups of stakeholders from various backgrounds shared their experiences and knowledge, which allows the boDEREC-CE partners to draw valuable conclusions in the light of developing the modePROCON decision-support tool.



Scan QR code above and go directly to the MOOC for modePROCON.



Startup screen of the modePROCON tool.

WORK PACKAGE WPT3 MODELLING

To investigate the fate of PPCPs, hydrological flow and transport models were developed at all boDEREC-CE pilot sites. For modelling, available existing data, as well as data collected and analysed within the boDEREC-CE project were used. In the

first step, a flow model was developed for each pilot site. In the second step, transport models were developed by considering the PPCPs of most concern in the area. Partners used different approaches and selected different PPCPs for modelling.

Pilot action cluster	Pilot actions in boDEREC-CE	Hydrological models	Transport model	PPCP selected for transport modelling
Surface water	DRESDEN-HOSTERWITZ, Germany	MODFLOW-OWHM	MT3DMS	Acesulfame-K 4-formylaminoantipyrine
Surface water	PO RIVER BASIN, Italy	HEC-HMS-RAS Mike NAM-HD TOPKAPI-Sobek	DELWAQ HEC-RAS 5.07	Iopamidol Diclofenac
Surface water	KOZŁOWA GÓRA, Poland	SWAT integrated with AEM3D	A conceptual transport model* was set-up	PFOS DEET Carbamazepine Oxypurinol Acesulfame-K
Groundwater	NEUFARN MUNCHEN, Germany	MODFLOW-2005	1D and 2D analytical models	Diatrizoate Oxypurinol DEET
Groundwater	LJUBLJANSKO KOTLINA, Slovenia	MODFLOW 2000	HYDRUS-1D	Carbamazepine Caffeine Propyphenazone
Groundwater	KÁRANÝ-JIZERA, Czech Rep.	DRUtes	DRUtes	Acesulfame-K Oxypurinol
Groundwater	Waidhofen/YBBS, Austria	LuKARS	A conceptual transport model* was set-up	DEET Progesterone Testosterone Caffeine Paraxanthine PFOS Simvastatin
Groundwater	JADRO CATCHMENT, Croatia	KarstMod	A conceptual transport model* was set-up	1H-benzotriazole DEET Ibuprofen Metformin

For 8 pilot sites several different modelling approaches were applied. 18 substances were selected for transport modelling - the most common parameter was DEET which was modelled in 4 out of 8 pilot sites.

WORK PACKAGE WPT4 PROSPECT

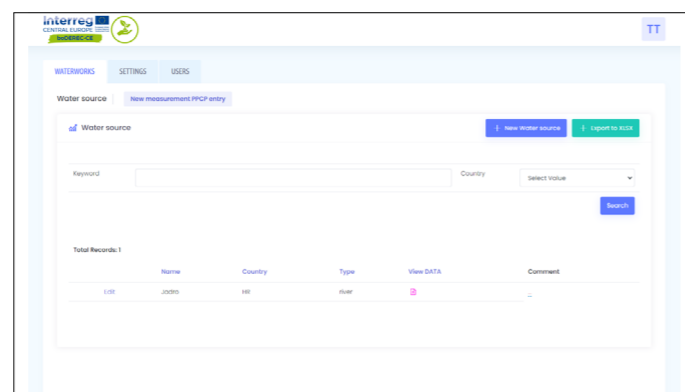
WPT4: Attenuating emerging contaminants - prospects and new approaches realisation started in January 2021 and aims to provide tools and recommendations for further action in order to attenuate emerging contaminants in water resources. These goals

The occurrence of PPCP in drinking water puts new tasks on waterworks. In particular, the activities should be focused on monitoring and reduction of PPCP concentrations in drinking water, which should be implemented in addition to regular obligations. Thus several tools were prepared. The first one is the Catalogue of technical and management solutions for PPCP mitigation. It is a comprehensive catalogue of globally available solutions for PPCP mitigation in water intended for human consumption. The catalogue contains more than 30 treatment technologies possible use for PPCP mitigation, recommendations as well as calculation of purification costs of 1m³ water per method.

Taking into account a lack of experience and knowledge gap on EC and PPCP boDEREC-CE delivered a decision making support tool for selecting optimal treatment option/method for PPCP concentration mitigation will be developed - wwDEMAST. The tool includes executive information systems, executive support systems, and on-line analytical processing.

were achieved through the implementation of three main activities, which include (1) Establishment of Bord of experts, (2) Elaboration of capacity building concept for waterworks and (3) Tackling future challenges - innovative legislative action.

During the boDEREC-CE realisation, especially stakeholders' involvement activities a need for assessing the waterworks capacities for new challenges connecting with PPCP problems occurred. Thus, the Self-evaluation form for waterworks was established to give a "cross-section" of the state of each waterworks in relation to the future requirements that will be set before them. The main question for watermarks is which of the necessary activities to reduce PPCP can be done by waterworks itself, and what part must be left to external experts? The survey consists of 19 questions divided into 5 groups. Its filling in requires a multidisciplinary approach giving various insights to waterworks capacity.

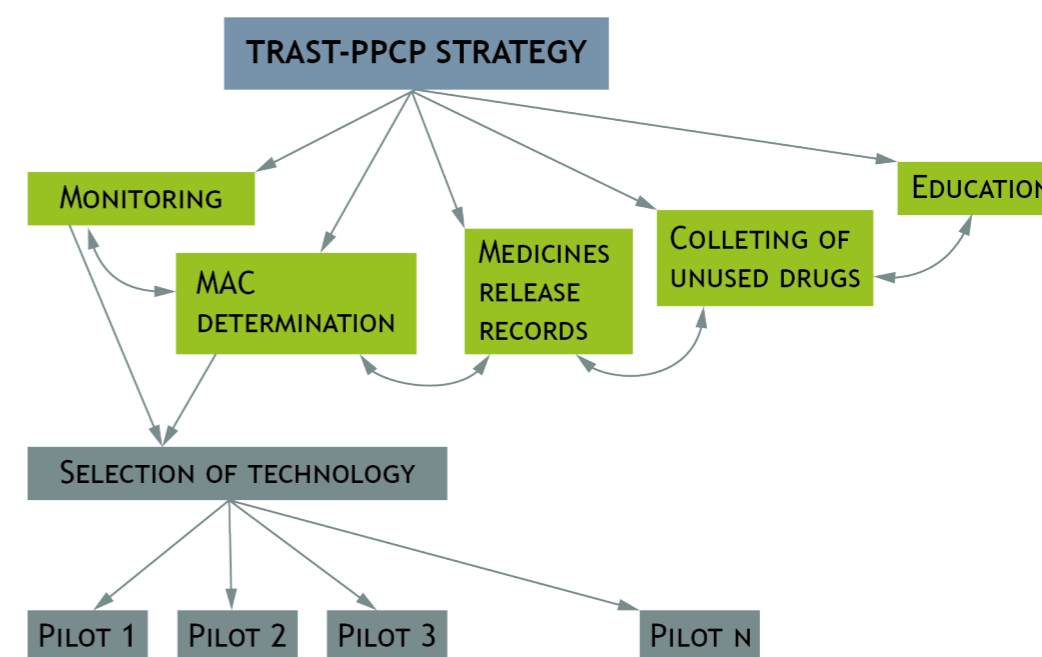


Screen of the wwDEMAST tool.

WORK PACKAGE WPT4 NEW APPROACHES

The most important boDEREC-CE output is TRAST-PPCP - Transnational strategy for PPCP mitigation in drinking water which summaries all work done under the project. The strategy is established as a recommendation and guidelines ("soft law") in order to better adapt to future changes in legislation. TRAST-PPCP recommends two types of actions - preventive/passive measures and curative/active measures. The first group includes recommendations for conducting the PPCP monitoring, emphasising a need for the determination of maximum acceptable concentrations (MAC) of PPCPs in drinking water. The activities consider also keeping records of production/consumption of medicines both for humans and animals. The strategy recommends also the organization of a common collection

system of unused or expired drugs. Special attention is being put on educating experts as well as the general public on potential PPCP pollution and its influence on drinking water resources. These activities can be carried out in parallel, independently of each other. The second group focus on the selection of optimal technology for drinking water purification. These measures require the more active participation of waterwork professionals. Due to potentially little "know-how" regarding the elimination of PPCPs from drinking water, it is recommended to set up "pilots" and test the available technologies on the mentioned micro-pilot devices, considering the involvement of waterworks representatives in this process from the very beginning.



Scheme of TRAST-PPCP recommended activities. The preventive/passive measures are marked green, curative/active are marked dark petrol.

WORK PACKAGE WPT4 BOARD OF EXPERTS

One of the most important tasks to fostering future cooperation and dissemination of the boDEREC-CE results was setting up the Board of experts. It was established as a non-profit organisation of interested experts who focus their efforts on the burning issue of emerging contaminants in water resources.

The Board of Expert members contributes to the institutionalization of the future cooperation in the scope of PPCP mitigation in Central Europe. The Board consists of 17 members from all project partner countries - experts from academia, research institutes, and water suppliers' organizations.

The Board held periodic meetings where the experts critically review all project results, update them with new findings (both scientific and legislative), ensure dissemination of results through communication with decision-makers, key stakeholders, and expert community,

ensure project capitalization and maintain cooperation beyond the project lifetime.

During the Final Conference, the Board of experts signed the Declaration for cooperation where the members state their will to foster cooperation in a field of emerging contaminants in drinking water resources and its mitigation also after the project framework.

The Board of experts emphasised the need for exchange of knowledge, good practices and experiences related to emerging contaminants and the need for endorsement of categories and priorities for emerging substances. The members declare their support in the harmonization of the analytical methods and monitoring tools that the risk of EC can be adequately addressed. Last but not least the members underlined the need of promoting EC and PPCP monitoring in water resources, especially drinking water resources.



The Board of Experts meetings have been held online due to epidemiological situation.

ENGAGEMENT OF STAKEHOLDERS AND GENERAL PUBLIC

From the very beginning, the project consortium put special attention to raising awareness and increasing the knowledge of stakeholders. The task was not easy, since most of the project was carried out in Covid-19 pandemic time. Nevertheless, several engagement activities were set up, both online and onsite. This includes two series of stakeholders' workshops and the

knowledge transfer to end-user meetings when project partners at the national level have recognised stakeholders' needs and built the capacity for tools developed under boDEREC-CE. During the project's lifetime, more than 50 meetings were organised, including public events. Representatives of more than 189 institutions worldwide participated in our targeted events.



Pictures presents the audience of targeted and public events organised under the boDEREC-CE framework.

At the end of the project, the Final conference was held to summarize the boDEREC-CE realisation. More than 100 participants from 12 countries joined the meeting. One of the main aspects was announcing the Board of Experts Agenda for future actions. Due to the still ongoing COVID-19 pandemic in Central Europe, the Final Conference was held online via Ms Teams. Additionally, for gaining more audience including the general public, the meeting was streamed live on Youtube.



The Final conference was streamed live via YouTube. You can find the videos on our YT Channel use link: <https://youtu.be/7zjcwsaKXM> or QR code on left.

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