EU4Environment in Eastern Partner Countries:
Water Resources and Environmental Data (ENI/2021/425-550)

SUMMARY REPORT: PROMOTE THE ADOPTION OF COVID-19 WASTEWATER MONITORING (ACTIVITY 1.4.2)

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ABOUT THIS REPORT

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ABOUT EU4ENVIRONMENT – WATER RESOURCES AND ENVIRONMENTAL DATA

This Programme aims at improving people's wellbeing in EU's Eastern Partner Countries and enabling their green transformation in line with the European Green Deal and the Sustainable Development Goals (SDGs). The programme's activities are clustered around two specific objectives: 1) support a more sustainable use of water resources and 2) improve the use of sound environmental data and their availability for policy-makers and citizens. It ensures continuity of the Shared Environmental Information System Phase II and the EU Water Initiative Plus for Eastern Partnership programmes.

The programme is implemented by five Partner organisations: Environment Agency Austria (UBA), Austrian Development Agency (ADA), International Office for Water (OiEau) (France), Organisation for Economic Co-operation and Development (OECD), United Nations Economic Commission for Europe (UNECE). The programme is principally funded by the European Union and co-funded by the Austrian Development Cooperation and the French Artois-Picardie Water Agency based on a budget of EUR 12,75 million (EUR 12 million EU contribution). The implementation period is 2021-2024.

https://eu4waterdata.eu

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List of abbreviations

ADA ..... Austrian Development Agency
BQE ..... Biological Quality Elements
CDC ..... Centre of Disease Control
DoA ..... Description of Action
DG NEAR ..... Directorate-General for Neighbourhood and Enlargement Negotiations of the European Commission
EaP ..... Eastern Partners
EC ..... European Commission
EECCA ..... Eastern Europe, the Caucasus and Central Asia
EMBLAS..... Environmental Monitoring in the Black Sea
ESCS ..... Ecological Status Classification Systems
EU ..... European Union
EUWI+ ..... European Union Water Initiative Plus
EU4EnvWD..... EU4Environment in Eastern Partner Countries: Water Resources and Environmental Data Programme
GEF..... Global Environmental Fund
ICPDR ..... International Commission for the Protection of the Danube River
INBO..... International Network of Basin Organisations
IOW/OIEau ..... International Office for Water, France
IWRM ..... Integrated Water Resources Management
NCDC..... National Centre of Disease Control
NESB ..... National Executive Steering Board
NFP ..... National Focal Point
NGOs..... Non-Governmental Organisations
NPD..... National Policy Dialogue
OECD..... Organisation for Economic Cooperation and Development
PCR..... Polymerase Chain Reaction, standard method for identification of viruses
RBD ..... River Basin District
RBMP ..... River Basin Management Plan
Reps ..... Representatives (the local project staff in each country)
ROM..... Result Oriented Monitoring
ToR..... Terms of References
UBA..... Umweltbundesamt GmbH, Environment Agency Austria

UNDP ..... United Nations Development Programme
UNECE..... United Nations Economic Commission for Europe
WFD ..... Water Framework Directive

Country Specific Abbreviations Armenia

EMIC ..... Environmental Monitoring and Information Centre (until January 2020)
HMC..... Hydrogeological Monitoring Centre (since February 2020)
MNP..... Ministry of Nature Protection
NCDC..... Armenian National Centre of Disease Control
SCWS..... State Committee on Water Systems
SWCIS..... State Water Cadastre Information System of Armenia
WRMA ..... Water Resources Management Agency

Country Specific Abbreviations Azerbaijan

Azersu JSC..... JSC Water Supply and Sanitation of Azerbaijan
MENR..... Ministry of Ecology and Natural Resources
NCDC..... Azeri National Centre of Disease Control
WRSA ..... Water Resources State Agency of Ministry of Emergency Situations

Country Specific Abbreviations Georgia

GWP..... Georgian Waters and Power
MENRP..... Ministry of Environment and Natural Resources Protection
NCDC..... Georgian National Centre of Disease Control
NEA ..... National Environment Agency
NWP..... National Water Partnership
US CDC..... United States Centre of Disease Control

Country Specific Abbreviations Moldova

AAM ..... Agency “Apele Moldovei”
AGMR..... Agency for Geology and Mineral Resources
AMAC..... Association of Apacanals
ANRE ..... National Agency for Economic Regulation of the Energy Sector (also regulates WSS)
EAM ..... Environment Agency Moldova
MoAgri..... Ministry of Agriculture (of the Republic of Moldova)
MoENV..... Ministry of Environment (of the Republic of Moldova)

Moldova..... Republic of Moldova
NAPH ..... National Agency for Public Health
SHS..... State Hydrometeorological Service

Country Specific Abbreviations Ukraine

MENR..... Ministry of Ecology and Natural Resources
NAAU ..... National Accreditation Agency of Ukraine
SAWR ..... State Agency of Water Resources
SEMS..... State Environment Monitoring System
UPHC..... Ukraine Public Health Centre

1. INTRODUCTION

The EU's multi-year action "EU4Environment – Water Resources and Environmental Data" aims at further supporting Eastern Partner countries in the preservation of natural resources in line with the European Green Deal and a post-COVID-19 green recovery. This action contributes to longer-term environmental, climate, and socio-economic resilience, and to improved human health and wellbeing, as well as to the achievement of the Sustainable Development Goals (SDGs) in the Eastern Partnership region. One activity promotes the adoption of Covid-19 wastewater monitoring, as outlined in the EC communication for EU Member States.

Wastewater health surveillance is a powerful and complementary tool to track, evaluate and predict the presence of contaminants and viruses in local populations. Wastewater is a mirror of the society connected to the sewerage systems and thus provides a collective sample of the current situation. Member States' experience in this area have shown since 2020 that surveillance of SARS-CoV-2 and its variants in wastewaters can provide a cost effective, rapid and reliable source of information on the spread of SARS-CoV-2 (and other relevant pathogens) in the population and that it can form a valuable part of an increased genomic and epidemiological surveillance.

Austria has been one of the first countries worldwide, which elaborated and implemented this concept since spring 2020 on a national scale. The same scientists and practitioners, who successfully supported the establishment of such a surveillance system in Austria, became engaged to transfer their experience and knowledge to EU4Environment partner countries.

Wastewater-based Epidemiology (WBE) refers to SARS-CoV-2 and its variants, poliovirus, influenza virus, emerging pathogens, contaminants of emerging concerns. Article 17 of the recast of the Urban Wastewater Treatment Directive (in force since January 2025) proposes all Member States to establish monitoring of WBE.

This report summarises the objectives of *Activity 1.4.2 Promote the adoption of COVID-19 wastewater monitorin*g, the executed work and the achieved progress and results in each country.

2. ACTIVITIES AND RESULTS

2.1. Promote the adoption of Covid-19 wastewater monitoring (*Activity 1.4.2*)

Wastewater based health surveillance is a novel tool and has been developed and improved during the Covid-19 pandemic. Experiences and lessons learnt from the Member States were shared with the EaP partners. Objective was to enhance cooperation between relevant health and environmental authorities by the following steps:

- Raise stakeholder awareness through virtual and in-person events;
- Transfer experience gained through the EU Sewage Sentinel System and national wastewater-based epidemiological sentinel surveillance systems for possible use by the public health sector as an early warning and de-warning system;
- Assess needed capacities, skills, equipment, sampling logistics and analytic procedures, select catchment areas and installations via dedicated bilateral collaborative working groups (e.g. via webinars);
- Provide training on methods for COVID-19 wastewater monitoring (e.g. via e-learning), including statistical analysis for forecasts, data handling, data interpretation, data visualisation;
- Promote a collaborative design of a required wastewater based epidemiological sentinel surveillance system for practical implementation;
- Offer data Processing, Statistical Analysis & Support for a Surveillance Conceptualization.

2.2. Preparatory Work

As the implementing consortium did not comprise the necessary knowledge about wastewater epidemiology, it decided to contract competent experts. A number of experienced organisations from Austria were invited in 2022 and 2023 via tenders to offer services for three types of expertise.

2.2.1. Sampling, Specialized PCR Analysis & Surveillance Conceptualization

Main tasks were to raise stakeholder awareness through virtual and in-person events. Crucial steps taken were:

- transfer experience gained through the EU Sewage Sentinel System and national wastewater-based epidemiological sentinel surveillance systems, for possible use by the public health sector as an early warning and de-warning system;
- assess needed capacities, skills, equipment, sampling logistics and analytic procedures, selection of catchment areas and installations via dedicated bilateral collaborative working groups (e.g. via webinars);
- provide training on sampling and specialized PCR- analytical methods for COVID-19 wastewater monitoring (e.g. via e-learning), including first data production;

- promote a collaborative design of a required wastewater based epidemiological sentinel surveillance system for practical implementation for each country;
- jointly implement pilot surveillance activities.

2.2.2. Specialized Analysis on Genomic Variant Screening & support for a Surveillance Conceptualization

Main tasks were to

- plan trainings on specialized PCR- analytical methods for COVID-19 variants wastewater monitoring (physically and/or e.g. via e-learning), including first data production and interpretation for each beneficiary country;
- promote and contribute to a collaborative design of a required wastewater-based epidemiological sentinel surveillance system for practical implementation for each beneficiary country with the focus on genome variants;
- design and conduct a training program and provide all necessary training material (presentations, handouts, standard operating procedures according to international standards, protocols, if necessary test datasets and e-learning tools as substitute where no physical on-site training is possible), including additional pathogens to be detected upon request.

2.2.3. Data analysis, statistics and data management

Main tasks were

- presentations, handouts, standard operating procedures according to international standards/EU Digital European Exchange Platform (EU4S-DEEP), protocols, test datasets, e-learning tools as substitute where no physical on-site training is possible) for country expert staff that shall be able to perform the recommended work on data and statistics according to these documents;
- transfer good practices and accompany appropriate IT and statistical work of the country experts for the purposes of demonstration / training and knowledge exchange of relevant techniques and good practices. The selected institutions should perform regular data collection and statistical analysis;
- make available results of the first data & statistical analysis in an accessible data storage, taking an interoperability with the EU Digital European Exchange Platform (EU4S-DEEP) into account.

In a first step, the EU4EnvWD national programme representatives reached out to their competent governmental bodies to identify relevant working groups and entities. As this subject was new and thematically beyond the scope of water management, several new contacts in the Ministries of Health and their subordinated entities (NCDCs, NAPH, UPHC) had to be established. Official letters were sent out to the Ministries of Health to introduce the programme and the aim of the output. The contracted partners developed **questionnaires** and circulated them via the programme representatives. Aim of the questionnaire was to gain an overview about the awareness and status of wastewater-based health surveillance in each country and about existing practices and equipment in order to provide suitable individual missions/trainings. Building on the results, a first workshop with the programme

representatives was held on 24 February, 2022 to explain the planned activities and discuss the next steps. After that, bilateral discussions with the beneficiaries in each country took place and on the fringes of missions for other outputs, contact to the relevant beneficiaries was established or fostered.

The Inception Report summarized the following general conclusions for Activity 1.4.2:

- There is high commitment and understanding for the need of the wastewater surveillance by all national competent institutions. However, an organizational basis for the collaboration between these entities with the water sector and sufficient budgeting for the implementation of a surveillance program (sampling, analysis, evaluation, prediction, reporting, purchase of equipment) should be scoped and secured, also at the policy level. This request has been forwarded to the experts working under Output 1.3 to take up action.
- Further discussions were needed to support decisions at the political level to establish and run wastewater Covid-19 surveillance. A workshop was prepared to bring stakeholders together and promote the establishment such new surveillance in each country: the related high-level Workshop involving also COM was held on 3 July 2023).
- Methodological in-depth training and further concretization of the surveillance were provided in additional missions carried out in December 2022.
- In terms of water pollution (and apart from Covid-19), it must be pointed out, that after having visited a number of wastewater treatment plants of the capital cities, the applied technologies differ significantly and, thus, have a more or less significant impact on the quality of the receiving waters. This has been taken into account in the activities dealing with the RBMP elaboration (see Output 1.1). Furthermore, in one case existing technological extensions and improvements could not become operative due to lacking political arrangements.

Progress and key results of work were regularly communicated to and reflected with UNECE for their work under Output 1.3. This helped raising more attention to the implementation of the Protocol on Water and Health that is coordinated by UNECE colleagues in Geneva and were EaP countries are Parties to.

2.3. Implementation

After analysis of the returned questionnaires, the team elaborated a concept together with the international experts. The team presented the concept and overarching scope of the new methodology to all identified national experts from the competent entities in online **kick-off workshops**.

The process revealed the following and fundamental specificities in the countries:

Table 1: Specificities, conditions and status of WBE in the EaP partner countries

Armenia	Main partners: Armenian NCDC, water committee, Veolia Full commitment of NCDC to WBE, readiness for trainings, some deficiencies in equipment identified and subjected to procurement Veolia appeared to be an obstacle for collecting wastewater samples
Azerbaijan	Partners: Azeri NCDC, Azersu Acknowledgement of NCDC to use WBE as important tool, deficiencies in equipment identified full collaboration with Azersu
Georgia	Partners: US CDC; Georgian NCDC, Georgian Waters and Power Full commitment of NCDC and GWP to WBE, excellent scientific and technical basis; however, the US NCDC supported the Georgian NCDC by a project on implementing WBE in parallel
Moldova	Partners: NAPH, ApaCanal Full commitment of NAPH to WBE, excellent collaboration with ApaCanal; minor support need in terms of equipment
Ukraine	Partners: PATH; UPHC, MoH PATH acted as co-initiator and coordinator to establish WBE in all UA regions; joint identification of fields of support and good collaboration with PATH/UPHC Government approved a new procedure for conducting epidemiological surveillance of pathogens of infectious diseases in household wastewater (in force since Dec., 2024)

First focus was put on sampling of wastewater, transfer of samples, analysis by means of PCR and identification of support needs. First missions were used to provide first trainings using real wastewater samples in order to proof the functionality of the existing equipment, assess any needs and demonstrate the operability of the suggested workflow. In all countries except AZ and UA (no missions possible), **SARS-CoV2 could be identified** in the collected wastewater samples during these initial missions. Subsequently, identified needs were procured and follow up missions (AM, MD, GE) organised.

At the same time, the team successfully liaised with the **network of the EU wastewater based epidemiology** in the regular EU Townhall Meetings (organised by the JRC) and obtained observer status in the EU's National Contact Point (NCP) meetings. Where applicable, the team promoted connections of national teams with the EU expert network. In monthly NCP meetings, EU4ENVWD was represented and reported about the status and progress of work in the partner countries.

During the implementation period, the following workshops and missions took place:

Table 2: List of missions and trainings carried out in the EaP partner countries

Date	event
24.02.2022	Workshop with country representatives, information about Activity 1.4.2. and requirements
March 2022	General EU4ENVWD kick off meetings; presentation of overview about Act. 1.4.2.
8.4.2022	Online kick off of Act. 1.4.2. in UA and MD
19.4.2022	Meeting with UA
27.4.2022	Online kick off in AM and GE
6.5.2022	Working meeting with UA
10.-13.5.2022	Mission to MD, contact with NAPH, MoH and first training on PCR methodology; inventory of equipment needs, first wastewater samples analysed
9.5.2022	Online meeting with AZ
09.2022	Mission to AM, contact and inventory of equipment needs NCDC; first wastewater samples analysed
09.2022	Missions to GE and AZ, first wastewater samples analysed
23+24.10.2022	Representation of EU4EnvWD at the Gates Foundation conference in Brussels (presentation of activities related to WBE)
12.2022	Mission to GE, training on PCR, normalization
02.2023	Mission to MD, training, identification of urgent needs
3.7.2023	Online High level Workshop to promote WBE at the level of Ministers and Deputy Ministers; joint event with the European Commission
5.7.2023	Side event at the 7th WHO Ministerial Conference on Environment and Health in Budapest, jointly with EC (JRC, HERA) and scientific key players from EU and beyond
11.2023	Representation of EU4EnvWD at the GLOWACON conference in Frankfurt (DE).
12.2023	Mission to AM, training of NCDC, liaise with the Water Committee and Veolia aiming to establish continuous WBE
16.1.2024	Mission to GE, National Policy Dialogue – strategic exchange with NCDC and MoH
23.01.2024	Mission to AM, exchange and discussion of possibilities for continuous WBE with NCDC, Water Committee and Veolia
30.1.2024	Mission to AM, training on variant sequencing
12.2024	Mission to MD, training on variant sequencing

2.3.1. Synopsis paper and high level workshop

Already during the inception phase after exchange with numerous national experts it became clear that a strategic document is missing, which explains the state-of-the-art of WBE, its benefits and advantages and the strategic elements to establish a continuous WBE in the countries. Building on their pioneering experience, the Austrian team elaborated a “synopsis paper”, which summarized all these points and which should become a basis for political decisions (governmental resolutions) to establish WBE and thus, secure inter-disciplinary collaboration among national entities.

A high level online workshop was chosen as a vehicle to present and share the document with responsible Ministers and Deputy Ministers in the EaP countries, jointly organised with the European Commission. Table 3 depicts the agenda of the meeting. The workshop intended to present experiences, benefits and advantages but also future challenges and should emphasise political decision-makers to promote WBE in their countries.

Table 3: Agenda of high level online workshop on 3 July, 2023

11:00	**Welcome and purpose of Workshop** Alexander Zinke, EAA
11:10	**Welcome by DG NEAR** Lawrence Meredith, DG NEAR
11:15	**Interventions from the EaP countries** Participants from the EaP countries are invited to share in 3-4 minutes each the status of implementing WBE in their countries AM, AZ, GE, MD, UA
11:35	**Wastewater based Epidemiology within EU4ENVWD: progress and further needs** EU4ENVWD team Prof. Norbert Kreuzinger, TU Wien Philipp Hohenblum, EAA Oliver Alber, AGES
12:05	**Wastewater based Epidemiology WBE at EU level** Bernd Gawlik, JRC Angela Bularga, DG NEAR Ana Burgos-Gutierrez, DG HERA Michel Sponar, DG ENV
12:35	**Break**
12:40	**Institutionalizing wastewater based epidemiology** EU4ENVWD European Commission
13:00	**Feedback from and discussion with officials from AM, AZ, GE, MD, UA** All
13:20	**Conclusion and outlook** Bernd Gawlik, JRC Alexander Zinke, EAA
13:30	**End**

The workshop was attended by **70** participants. Its main conclusions of the can be summarized as follows:

- WBE has a global dimension, the interest and activity is steadily growing. The European Commission runs several support actions in coalition with international partners. The international conference “Towards a Global Wastewater Surveillance System for Public Health” organised by the European Commission will take place on **November 15-17, 2023**.
- The recast of the European Urban Wastewater Treatment Directive will **oblige EU Member States** to implement WBE.

- Benefits and advantages of WBE were summarized in various documents, one of which addresses the institutionalization of WBE specifically at national level in the Eastern Partnership countries. Coordination and sustainable budgeting should be provided as soon as possible to capitalize on all WBE benefits. Various parties reported progress in WBE surveillance.
- Further trainings on data management and statistics as well as on sequencing under EU4ENVWD are being prepared and will commence in September 2023.
- The final declaration of the **WHO 7th Ministerial Conference on Environment and Health** refers to WBE in its commitment 24: https://www.who.int/europe/publications/i/item/EURO-Budapest2023-6

All documents were shared with the participants, especially the synopsis paper.

2.3.2. Material support

Although most of the first trainings succeeded in applying the proposed methodology and identifying the SARS-CoV-2 virus in real wastewater samples, there is a need for support of materials, consumables and, in some cases, for equipment to allow for smooth and compliant processing of wastewater samples. In particular, the following needs were identified and a related support provided:

Table 4: Supply needs identified and provided to realize WBE

AM	Centrifuge rotor for compliant virus separation PCR test kits Supply for variant screening	Delivered 23 October, 2023 May, 2023 Jan., 2024
AZ	Refrigerated centrifuge PCR test kits	Both could not be realized due to receding interest of Beneficiary
GE	PCR test kits	Delivered in Aug., 2023
MD	PCR test kits (2 tranches) Supply for variant screening	Nov. 2024 Dec., 2024
UA	Supply of two autosamplers to support wastewater sampling	Transferred on 22-24 Nov 2024 Installed and operating in 2025

In the course of the project and benefiting from the team's network, three used autosamplers in Vienna became vacant and were handed over to UBA to support entities in the Eastern Partner countries. Graciously, these samplers at a value of some 8.000 € each were generously donated by the Municipality of Vienna (Wien Kanal). Since autumn 2022, the UBA team had undertaken numerous efforts to identify suitable recipients and to then overcome transport and import obstacles: for various reasons this transfer proofed almost impossible. Eventually, thanks to liaison with the PATH team and to the generous car transport by UNEP in Kyiv, UA has received in November 2024 two autosamplers, specifically the wastewater treatment plant in Krywyj Rih. As their WWTP managers explained, the samplers will support

their monitoring of treatment and allow WBE surveillance. Both instruments are in operation since 2025 (see photos).

Figure 1: Purchased rotor in the centrifuge in operation (© UBA)

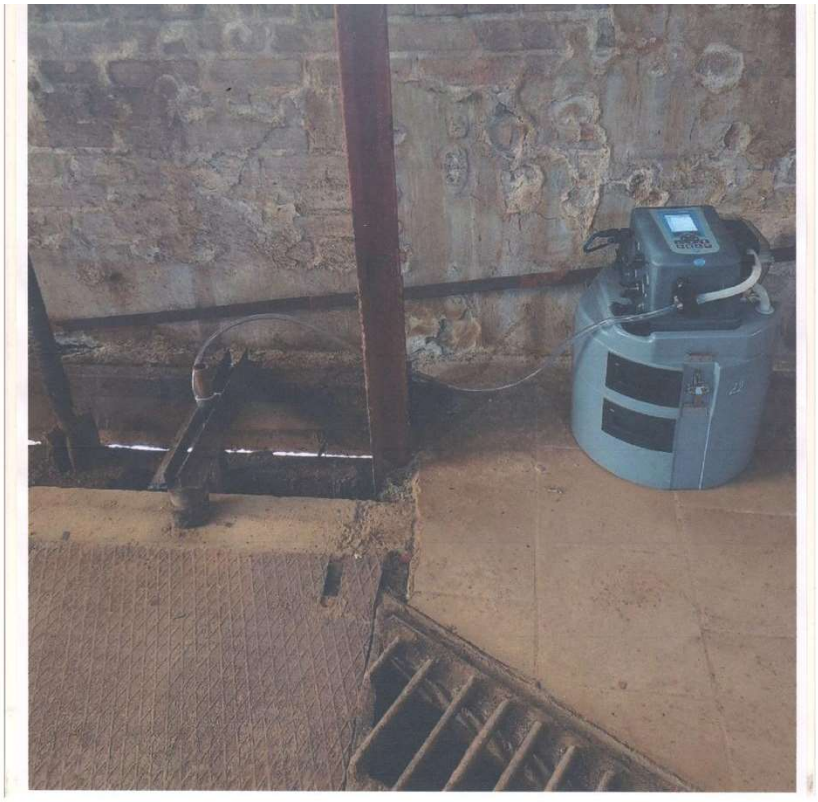

Figure 2: Autosampler in operation in wastewater treatment plant in Krywyj Rih (© Krivbasvodokanal)

2.3.3. Country wise progress and status of WBE

Ukraine

By the end of the implementation period, only this country achieved to come to a **continuous surveillance** on a formalized basis. PATH managed to extend the surveillance in 2024 to all Ukrainian regions. In the course of the project, EU4EnvWD could establish a regular exchange format with the PATH team, the UHPC (Ukraine Health Protection Centre) and the MoH, and it provided regular online trainings, especially on the normalization of data. Efforts to also extend trainings towards sequencing and data management, statistics and reporting did not substantiate. Further efforts to carry out trainings on data evaluation, statistics and reporting (dashboard) did not succeed, as no relevant counterparts and trainees could be identified in the country.

In March 2024, Minister of Health Viktor Liashko ordered a new "Procedure for conducting epidemiological surveillance of pathogens of infectious diseases in household wastewater". Upon adoption by the Cabinet of Ministers, it entered into force in December 2024 and constitutes the first such legal framework in the EaP region. National Guidelines on Wastewater Surveillance constitute the official legal framework for implementing wastewater surveillance in Ukraine.

Moldova

Moldova could be supported to achieve **two episodes** of continuous surveillance of Chisinau's wastewater. NAPH was ambitious in analysing wastewater samples and receiving trainings on PCR optimization and variant screening (sequencing). A dedicated training on sequencing was organised in Chisinau in Dec 2024. In order to make full use of equipment, some missing equipment parts were purchased by EU4EnvWD and handed over to NAPH. Additionally, the institute has been equipped with a sufficient number of PCR test kits to maintain their surveillance efforts. Efforts to carry out trainings on data evaluation, statistics and reporting (dashboard) were not successful, as no relevant counterparts and trainees could be identified.

Armenia

NCDC provided great support and updates on equipment (rotor as described) and supply of test kits was provided by EU4EnvWD. After a first successful training on processing a real wastewater sample in September 2022, however, ambitions to establish a continuous surveillance system got stuck. In the further course, Veolia did not grant access to the wastewater treatment plant. Interventions by the NCDC and by the Water Committee did not help. However, due to the existing scientific network and the good collaboration, a training on sequencing of wastewater samples could be carried out in January 2024.

Georgia

In one preparatory and two training missions, technical details on treatment and preparation of samples as well as on purification of samples could be trained. The Georgian NCDC comprises an excellent and state-of-the-art equipped laboratory with highly educated and trained staff. After two successful trainings until end of 2022 the NCDC informed the partners that the US CDC starts a collaborative project with the NCDC on wastewater-based health surveillance with a detailed work programme and the aim to establish a continuous monitoring of several sites in Georgia. Both the EU and US teams agreed to remain in touch and establish exchange and update on a regular basis. As a result, a number of EU expert online

training sessions were held. Attempts to extend trainings towards data evaluation, statistics and reporting (dashboard) did not succeed.

Azerbaijan

One mission to Baku took place in September 2022 to discuss the basis of WBE and establish collaboration between wastewater treatment and the NCDC. The EU team jointly took with local experts one wastewater sample and transferred it to NCDC in Baku, followed by an initial training on the basics of sample treatment, purification and analysis. However, against the information provided in the questionnaire, the existing equipment was not fully compliant and some essential parts were missing. Thus, the identification of SARS-CoV-2 did not succeed. Repeated later attempts to support the procurement of missing items finally failed and no further missions to AZ took place.

2.3.4. Training Details

PCR trainings

Wastewater represents a collective sample of the society residing in the sewage catchment area. It has been proven, that wastewater surveillance for COVID-19 can very well reflect the development of a pandemic and even predict its development. Wastewater samples should be 24 hours flow or time proportionate composite samples, which ideally are taken twice a week as part of routine sampling, and can be handed over directly to the laboratory. After separation of particulate components (centrifugation), the virus RNA/TNA are extracted and purified and the resulting extract can be integrated in the “normal” PCR routine analyses used for human samples to calculate virus loads per capita per day and detect the share of variants. Results will be processed and visualised in order to follow and predict the course of the pandemic.

Trainings on the basics of wastewater based epidemiology and particularly on PCR measurement were highlighted in chapter 2.2. As all targeted local health organisations were responsible for human testing of SARS-CoV-2, the necessary equipment for the innovative monitoring was available and regular testing of human samples performed. The newly offered EU methodology tried to keep additional efforts to extract and measure the virus from wastewater samples low, and it aligns with the protocols on human testing. Specific Standard operation procedures were developed, handed over to the partner laboratories and jointly used as a basis for the trainings.

Special focus was laid on the normalization of results. Wastewater shows quantitative and qualitative fluctuations, which are influenced by the sewer systems and other factors. This approach takes into account routine wastewater parameters and specifically Ammonia (NH_4), which corresponds with the discharge of persons connected to the sewer. This concept has been introduced to all countries and proofed important to calculate the virus loads and number of infected people.

Figure 3: Training on virus extraction and measurement at NCDC laboratory in Sept. 2022, Yerevan, AM (© UBA)

Sequencing

This step in the surveillance process could be realised only late, despite early efforts to execute it. This was due to the delayed progress achieving a permanent surveillance system.

Armenia

After identifying the Institute of Molecular Biology NAS RA as the right target body, several online meetings were organised in August and October 2023 to discuss technical details of trainings. Differences in the set-up of their equipment would have led to high costs of analysis, thus a special protocol for MinION (Oxford Nanopore) has been developed by the EU team. The training in Jan 2024 started with a thorough theoretical training, followed by practical work in the laboratory. The training was held in cooperation with the NCDC laboratory, which extracted the wastewater samples according to the protocol. However, sequencing of the extracts was not successful. In order to demonstrate the process, a sample extract from Austria was processed and an adapted bio-informatical analysis was carried out. This yielded in a tailored protocol, which could be successfully implemented in Yerevan in January, 2024.

Georgia

After several attempts, an online meeting on full genome analysis of wastewater samples was organised, which led to further follow up meetings in March 2024. They served to discuss local problems in the implementation of the protocols for analysis. Following discussions with colleagues from the University of Nebraska in March 2024, modifications to the protocols were proposed, which proofed successful in practice. In order to check this, five samples were sent from Georgia to Austria in May 2024 and analysed according to the protocol. However, the analysis was not successful and it is suspected that despite chemical stabilization the samples degraded during the transport.

Moldova

In order to prepare a training on sequencing, several consumables needed to be purchased beforehand. Despite the availability of alternative methods, NAPH requested to be trained on the Illumina platform, which has relatively high operational costs compared to alternatives, especially when a low number of samples is analysed. An agenda for the training was agreed and accomplished in November 2024. An instrument to measure the size of fragments of nucleic acid, however, was missing and an alternative instrument was purchased on short notice by EU4EnvWD, but could not be delivered in time. In the course of the training it turned out that the extraction of wastewater samples could not be accomplished correctly and was performed by a Russian instrument, which was not compliant with the protocol. 23 wastewater samples from Chisinau and one human sample were analysed. It turned out that the bio-informatical evaluation did not yield in useful results due to the extraction, but the process could be demonstrated using the human sample and the personnel could be trained accordingly.

In conclusion, the capacity building in all three countries could not be completed as originally planned mainly due to very low progress in this innovative process at local level (AM, GE, MD) or due to the war in Ukraine. Therefore, the started work at initial or pilot level should be continued and WBE surveillance be raised to a continuous level. The extraction method should be better aligned with the proposed one to guarantee proper sequencing. It could also be envisaged to participate in laboratory inter-comparisons to improve the performance of the local labs. More emphasis should be put on legal framing and sustainable budgeting of surveillances, as suggested in the synopsis paper.

Data management and statistics

Main challenges arose in identifying suitable candidates for carrying out trainings on data management and statistics of WBE surveillance data the participating countries. Therefore, the consultants hydro-IT and AGES collaborated closely with the local agencies to address these issues. Instead of conducting country-specific workshops, the team generated comprehensive general work plans to assess country-specific needs with the available participants. Two successful workshops in May and July 2023 were co-conducted to foster support from stakeholders and high-level representatives in each country, and to enhance EU4EnvWD visibility and availability. In response to the absence of direct partners, these general work plans empowered participating countries to make informed decisions for effective implementation.

During the implementation phase, the planned activities initially included evaluating the needs of the recipient countries together with the stakeholders and the project team, creating a tailored workshop series for each country (or joint workshops, where applicable), and conducting these workshops through a mix of online meetings but also in-person visits when possible. However, securing programmer teams (or the required funding in the in the recipient countries) proved unattainable. Despite promising progress during the extended project time, these challenges persisted.

As a result, the workshops were prepared based on assumed needs rather than on direct evaluations. The EU team prioritized coordination meetings to advance participant recruitment efforts and refine the workshop materials. Several promising meetings in the second half of 2023 with potential participants (esp. from NCDC in Georgia) indicated progress in identifying suitable collaborators. As the preparations progressed, it became clear that conducting the workshop with the available personnel and resources at the NCDC was not feasible, at this time. Unfortunately, despite the extensive efforts and the high-level engagement from authorities, **no suitable participants could be found in any of the receiving countries** by the end of the implementation phase. This outcome, while disappointing, highlighted the complexities of coordinating such initiatives across diverse geopolitical and administrative landscapes. Nonetheless,

the groundwork laid during this phase—through meticulous planning and strategic collaboration—provided valuable insights and prepared the team for potential future engagement with the receiving countries. Consequently, the planned budget could not entirely be spent as no physical missions nor in depth trainings could be implemented due to the reasons explained above.

3. Conclusions

Wastewater health surveillance is a powerful and complementary tool to track, evaluate and predict the presence of contaminants and viruses in local populations. Wastewater is a mirror of the society connected to the sewerage systems and thus provides a collective sample of the current situation. Member States' experience in this area have shown since 2020 that surveillance of SARS-CoV-2 and its variants in wastewaters can provide a cost effective, rapid and reliable source of information on the spread of SARS-CoV-2 (and other relevant pathogens) in the population and that it can form a valuable part of an increased genomic and epidemiological surveillance.

Surveillance of SARS-CoV-2 (and other pathogens) in wastewater can provide important complementary and independent information to public health decision-making process in the context of the recent COVID-19 pandemic. Consequently, it became common sense in the EU and beyond that wastewater monitoring needs to be included more systematically in the national testing strategies for the detection of the SARS-CoV-2 virus and further pathogens.

EU4EnvWD included this novel tool as Activity 1.4.2 in the concept of the action and transferred the knowledge and experience of Member States to our EaP partners. Awareness of this tool was high in all of the countries and it soon turned out that there are some prerequisites needed to introduce and establish a functional and continuous system. The idea of wastewater surveillance is driven by health authorities, which benefit from the information and knowledge gained, but it **requires collaboration with a number of additional players and competences**.

Therefore, such a system should be **formalized and institutionalized** to regulate collaboration and responsibilities and guarantee sustainable budget. A high level workshop addressed the necessary institutionalization and a synopsis document has been circulated to give a guidance for this process. This also fed into the new Ukrainian Procedure for Epidemiological Surveillance of Pathogens of Infectious Diseases in Household Wastewater (2024); national Guidelines on Wastewater Surveillance serve as the official legal framework for implementing wastewater surveillance in Ukraine: this constitutes a **good model for other EaP countries**.

Laboratories in the countries have vast experience with human testing of SARS-CoV-2 and further pathogens and are well equipped. In order to comply with the protocols for extraction and purification of wastewater samples, some equipment was missing or had a lower performance than required. EU4EnvWD purchased missing instrumentation and supplied laboratories with consumables and test kits. Further to that, two auto-samplers, which facilitate and improve the quality of wastewater sampling, could be donated to a treatment plant in Ukraine, which support the monitoring process. Additional trainings on individual steps were successful and a lot of training material has been prepared and shared with the experts for their use. This applies for both PCR testing and genome sequencing.

In terms of **data management**, despite all efforts taken to identify relevant counterparts, only some basic discussions and exchanges could be organised, as relevant national experts or entities were not available.

All in all, a **continuous and fully fledged surveillance system could be established by PATH in Ukraine**, with substantial contributions provided by EU4EnvWD. In Moldova, two episodes of continuous wastewater surveillance could be established, where the last one coincided with the training on sequencing. In Georgia, the US CDC led the process with significant contributions of EU4EnvWD. In Armenia this process got stuck, although all prerequisites were available to establish a system. In Azerbaijan, despite all efforts of support, the process could not be developed beyond a first pilot exercise.

As a result, EU4EnvWD could only initiate and start such surveillance. Future EU support is recommended.

4. Annex

4.1. Synopsis paper (separate document)

4.2. Conclusion of high level workshop on 3 July, 2023

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EU4Environment
Water and Data in Eastern Partner Countries

High-level Regional Workshop on Wastewater-based Epidemiology (WBE) – follow up notice

Monday 3 July, 2023 at 11:00 – 13:30 CEST

Dear Participant!

The team of EU4Environment – Water Resources and Environmental Data (EU4WD) would like to thank all participants for attending the high-level regional workshop on wastewater based epidemiology! In particular, we thank all presenters for their contributions and all EaP country representatives for their valuable interventions!

The main conclusions of the workshop can be summarized as follows:

- WBE has global dimension, the interest and activity is steadily growing. The European Commission runs several support actions in coalition with international partners. The international conference "Towards a Global Wastewater Surveillance System for Public Health" is organised by the European Commission and will take place on **November 15-17, 2023**.
- The recast of the European Urban Wastewater Treatment Directive will **oblige EU Member States** to implement WBE.
- Benefits and advantages of WBE were summarized in various documents, one of which addresses the institutionalization of WBE specifically at national level of the countries of the Eastern Partnership. Coordination and sustainable budgeting should be provided as soon as possible to capitalize on all the benefits of WBE. Progress has been reported.
- Further trainings on data management and statistics as well as sequencing under EU4WD will commence in September; preparations are in progress.
- The final declaration of **WHO 7th Ministerial Conference on Environment and Health** refers to WBE in its commitment 24: https://www.who.int/europe/publications/i/item/EURO-Budapest2023-6

Next steps

As promised during the workshop, we are happy to provide the presented material. Please use the following link to download the presentations and additional materials:

https://docs.umweltbundesamt.at/s/AnHLqjjJCMHi5e2

In case of questions or requests related to the workshop on 3 July please do not hesitate to contact philipp.hohenblum@umweltbundesamt.at.

This message is sent to all invitees and participants of the event as well as to all persons who were additionally nominated in response to the invitation. Please feel free to forward this email to other persons interested in the topic.

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Water and Data in Eastern Partner Countries

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