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EUWI+ EU WATER INITIATIVE FOR EASTERN PARTNERSHIP

European Union Water Initiative Plus for
Eastern Partnership Countries (EUWI+): Results 2 and 3

ENI/2016/372-403

LABORATORY ASSESSMENT REPORT BELARUS

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Abbreviations

AFS ..... Atomic fluorescence spectroscopy
BSCA ..... Belarusian State Centre for Accreditation
DAD ..... Diode array detector
DOA ..... Description of action
DOC ..... Dissolved organic carbon
EC ..... European Commission
EaP ..... Eastern Partnership
EECCA ..... Eastern Europe, Caucasus and Central Asia
EU ..... European Union
EUWI ..... European Union Water Initiative
ENP ..... European Neighbourhood Policy
EPIRB ..... Environmental Protection of International River Basins
EQS ..... Environmental Quality Standards
FLD ..... Fluorescence detector
GC ..... Gas chromatography
HPLC ..... High-performance liquid chromatography
ISO ..... International Standards Organisation
LC ..... Liquid chromatography
LLE ..... Liquid-liquid extraction
LOD ..... Limit of detection
LOQ ..... Limit of quantification
MS ..... Mass spectrometry
NFP ..... National focal point
NPD ..... National policy dialogue
PTS ..... Proficiency testing scheme
QA ..... Quality assurance
QC ..... Quality control
QM ..... Quality management
RBMP ..... River Basin Management Plan
RCAC ..... Republican Centre of Analytical Control
RPS ..... Research and Production Centre for Geology
SAQEM ..... Strengthening the Air Quality Monitoring and Environment Management in Belarus
TOC ..... Total organic carbon
USAID ..... United States Agency for International Development
WB ..... World Bank
WFD ..... Water Framework Directive
WSS ..... Water supply and sanitation
WTP ..... Water treatment plant
WUA ..... Water Users Association

Country Specific Abbreviations – Belarus

BSCA..... Belarusian State Centre for Accreditation

CRICUWR ..... Central Research Institute for Complex Use of Water Resources

Minprirody..... The Ministry of Natural Resources and Environment protection

NSSD..... National Strategy for Sustainable Development

RCAC..... Republican Centre of Analytical Control

1 PROJECT SUMMARY

The Eastern Partnership (EaP) is a policy initiative launched at the Prague Summit in May 2009. It aims to deepen and strengthen relations between the European Union and its six eastern neighbours: Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine.

In recent years, the countries of the Eastern Partnership have demonstrated a willingness to align their water policies and practices with the general principles and specific requirements of the EU Water Framework Directive (WFD), as well as other thematic and sectoral water directives and UN Multilateral Environmental Agreements (MEAs). Moreover, Georgia, Moldova, and Ukraine have assumed commitments to reform water policies and implement the EU water *acquis* as part of the Association Agreements signed with the EU in 2014.

It is within this context that the *European Union Water Initiative Plus for the Eastern Partnership* (EUWI+) for Eastern Partnership Countries was initiated by the Directorate-General for Neighbourhood and Enlargement Negotiations (DG NEAR) of the European Commission.

The *European Union Water Initiative Plus for the Eastern Partnership* (EUWI+) was launched in September 2016 to assist the six Eastern Partnership countries to approximate to the EU Water Framework Directive and its associated directives. Its objective is to improve the sustainable management of water resources with a focus on trans-boundary river basin management.

EUWI+ focuses on five thematic areas:

- Legislation, policy development and institutional consolidation
- Laboratory and monitoring system enhancement
- River Basin Management Plan development
- River Basin Management Plan implementation
- Public awareness, communications, and data/information management

The OECD and UNECE are implementing activities under thematic area 1. Thematic areas 2–5 are being undertaken by a consortium of EU member states comprised of the Environment Agency Austria (UBA) and the International Office for Water (OIEau/IOWater) of France. Experts from other EU member states will also be involved in project activities.

The budget for these thematic areas for all six countries amounts to a total of EUR 24.6 million and is financed by the European Union with contributions from the governments of Austria and France. Its planned period of operation is from September 2016 until August 2020 (48 months).

A website has been created (http://euwipluseast.eu/en/) for the publication and dissemination all the data, information and services developed and used within the framework of this project.

2 EXECUTIVE SUMMARY

The *European Union Water Initiative Plus for the Eastern Partnership* (EUWI+) was launched in September 2016 to assist the six Eastern Partnership countries in approaching the EU Water Framework Directive and its associated directives. The project objective is to improve the sustainable management of water resources with a focus on trans-boundary river basin management.

In order to establish project priorities and targets, an assessment of the current laboratory situation for the hydro-chemical testing of water was carried out during the second and third quarters of 2017 with the aim of identifying gaps and fields of improvement in the following areas, as defined in the description of the action (DOA) to the Grant Contract.

The assessment of laboratory infrastructure, personnel capacities, analytical quality assurance, accreditation status, WFD-relevant sampling and testing methods, and documentation were completed in the third and fourth quarters of 2017.

Laboratory infrastructure: The Republican Centre of Analytical Control (RCAC) has a total of 22 laboratories, with the central laboratory situated in Minsk. Among others, the laboratory for physical-chemical measurements has been nominated by the beneficiary for technical support via the EUWI+ project. The current accreditation certificate is valid for all 22 laboratories until September 2021. The EUWI+ project should assist with method expansion and adoption for additional priority substances in the laboratory for physical-chemical measurements. The central laboratory holds ISO 17025 laboratory accreditation issued by the Belarusian State Centre for Accreditation (BSCA). The current accreditation certificate is valid until May 2021 with an accreditation scope that also includes 18 priority substances.

In addition, the Central Laboratory of the Research and Production Centre for Geology (RPS) should be supported by the EUWI+ project, mainly through participation in various training activities.

General staff capacities: The laboratory personnel of the RCAC's laboratory for physical-chemical measurements, consists of six staff members all of whom have a university degree in either chemistry or biology. The personnel are well trained, committed and motivated to perform their assignments. They therefore meet personnel capacity needs.

WFD-relevant testing and sampling methods: Surface water monitoring at the selected RCAC laboratory is well established and a number of WFD-relevant testing methods for water and sediments already have accreditation (acc. to EN/ISO IEC 17025:2005) from the Belarusian State Centre for Accreditation (BSCA) and include numerous priority substances. Assistance from EUWI+ with regard to further method expansion and adoption for additional priority substances is planned.

New equipment: The needs for additional equipment for the analysis of new parameters and progress towards the WFD have been drawn up and harmonised with the RCAC.

Owing to recent donations of numerous analytical instruments, there is no need for procurement in the case of the Central Laboratory of the Research and Production Centre for Geology (RPS). EUWI+ project support should be limited to selected technical and QM training, reaccreditation and the supply of various items of small laboratory equipment.

Accreditation status: As both laboratories already hold EN ISO/IEC 17025 accreditation for testing and have an appropriate quality management system, support under this activity will focus on participation in proficiency testing schemes (PTS) for the water analysis of selected groups of parameters, study visits and training regarding selected quality management issues.

Training: Three different types of training courses should be provided for the laboratories: (i) General laboratory training that can be conducted independently from equipment, **(ii)** Hands-on training with existing equipment and (iii) Training on new equipment. The general training curriculum has been prepared and harmonised with the laboratories. In addition, the supply of the relevant ISO- and chemical reference standard for existing equipment is foreseen, as well as method validation and the training of laboratory personnel. A list of parameters and methods has been drawn up for the new equipment and as soon as the supplier has successfully installed the equipment, training can begin.

Recommendation: The full implementation of WFD-compliant monitoring exceeds the scope of the project. The authors recommend a step-by-step development path for establishing full capacity for the complete range of priority substances, as well as the development of environmental quality standards (EQS) for biota.

3 INTRODUCTION

The European Neighbourhood Policy (ENP) provides a framework for closer relations between the EU and its neighbouring countries. The European Union Water Initiative Plus for Eastern Partnership Countries project (EUWI+) aims to furnish the neighbouring countries with further support in improving their water quality and has a special focus on trans-boundary river basin management in the light of the WFD principles.

The EUWI+ is based upon the lessons learned from several development initiatives of the European Union in the water sector in Belarus and the EUWI EECCA and EPIRB projects in particular.

A vital strategic element of the EUWI+ is to assist Belarus in the development of its relevant institutions as sustainable structures for the WFD-compliant management of its water resources. The current institutional structures and commitment of the Belarusian project partners are considered to be a good basis for the implementation of EUWI+. The institutional structure in Belarus is stable and the fluctuation of experts is seen as a minor issue.

One key, outstanding challenge is the further enhancement of water monitoring capacity, ranging from the geographical coverage of monitoring networks, to laboratory infrastructure and the methodological basis for sampling and analysis.

Monitoring and appropriate laboratory capacities play a central role in the implementation of the WFD. Therefore, the WFD's daughter directive on technical specifications for chemical analysis and the monitoring of water status (Commission Directive 2009/90/EC[1] – QA/QC Directive) duly addresses quality assurance, comparability and the reliability of analytical results. Accreditation provides government bodies and regulators with confidence in the technical competence and data quality generated by the laboratories carrying out testing.

Consequently, the main objective of the EUWI+ project is to strengthen the monitoring infrastructure (monitoring network and laboratory infrastructure, sampling, measurement and laboratory equipment incl. maintenance thereof), which is closely related to and goes hand-in-hand with activity 2.2.1 on capacity building through staff training (sampling, analytics, QA/QC, accreditation and ecological status or potential determination), which also contributes to output from activity 2.3, the implementation of RBMPs.

The assessment was carried out by visiting the laboratories involved in person, in order to monitor existing equipment, personnel, infrastructure and the laboratory premises on the basis of the EN ISO/IEC 17025[2] requirements for testing laboratories and by examining the list of required parameters in the the WFD and checking their degree of implementation.

The main focus of this assessment report is on chemical analyses, including the physical-chemical parameters and priority substances according to the Commission Directive 2013/39/EC[3] and corresponding QA/QC topics, as well as the determination of BQEs, their supporting physico-chemical elements and hydro-morphological elements. The assessment of the surface and groundwater monitoring systems, including biological and hydro-morphological quality elements, is summarised in a separate assessment report.

[1] COMMISSION DIRECTIVE 2009/90/EC of 31 July 2009, which pursuant to Directive 2000/60/EC of the European Parliament and of the Council, establishes technical specifications for the chemical analysis and monitoring of water status.
[2] ISO/IEC 17025:2005, General requirements for the competence of testing and calibration laboratories, International Standard Organisation, Switzerland.
[3] Directive 2013/39/EU of the European Parliament and of the council amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy.

4 CHEMICAL LABORATORY ASSESSMENT OBJECTIVES

In order to establish project priorities and targets, an assessment of the current laboratory situation for the hydro-chemical testing of water was carried out to identify gaps and areas of improvement in the following fields, as defined in the description of the action (DOA) of the grant contract:

- Appropriate analytical equipment, laboratory infrastructure and consumables (feeds into Act. 2.1.2)
- (Further) needs for technical support for accreditation (feeds into Act. 2.1.3)
- Needs for training (feeds into Act. 2.2.1)
- Needs for a (further) increase in capacities and the strengthening of the technical competence of the administrative bodies' personnel (feeds into Act. 2.1.3 and 2.2.1)

The current report summarises the findings of the laboratory assessment, which are described in detail in the mission reports and are an essential part of the assessment activities. The mission reports also provide some specific technical recommendations for the individual laboratories, which can be easily implemented within the daily routine. These recommendations are not subject to the summarised assessment report.

Moreover, the assessment report identifies gaps and proposes actions aimed at the sustainable implementation of the WFD within the EUWI+ project, and offers a strategic outlook on the further action needed beyond the time frame of the EUWI+ project.

5 ASSESSMENT METHODOLOGY

During the inception phase there was already an opportunity for short visits to selected laboratories involved in regulatory water monitoring. In addition, laboratory questionnaires were distributed in order to gather relevant information in a systematic manner, i.e. a brief description of the laboratory, general personnel capacities, laboratory facilities, equipment, test methods, analytical quality assurance, documentation, reporting and the support needed for the EUWI+ project. Together with the country priorities and results from the previous EPIRB project, this information provided an initial indication of the current status and the basis for the in-depth, on-site assessment of selected candidate laboratories under project activity 2.1.1.

The assessment methodology comprised the following aspects:

- General staff capacities
- Laboratory facilities and infrastructure
- Analytical equipment, spare parts and consumables
- WFD relevant testing and sampling methods (detailed methodology see Table 1)
- Status of accreditation (based on the ISO/IEC 17025 requirements)
- Training needs

5.1 Parameter assessment approach

The figure below illustrates the general procedure for the in-depth assessment of the current laboratory scope of analysis for WFD parameters. The Commission Directive 2013/39/EC[4] "As regards priority substances in the field of water policy" not only defines the 45 priority substances, but also indicates the EQS values of the corresponding parameters in the relevant matrix (inland and other surface water and biota). Current analytical methods were compared with state of the art analytical methods for the determination of priority substances in surface water.[5] Analytical methods for the determination of priority substances in biota were compared with the methods indicated in the guidance document 33[6]. Apart from the assessment of priority substances in surface water, the WFD defines six physico-chemical quality elements (thermal conditions, oxygenation, salinity, nutrient status, acidification status, other pollutants). However, the EU member states are responsible for the selection of the relevant parameters for physico-chemical monitoring. Therefore, the guidance document published by the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management was used for the current physico-chemical parameter assessment.[7]

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[4] DIRECTIVES DIRECTIVE 2013/39/EU OF THE EUROPEAN PARLIAMENT AND OF THE OUNCIL of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy.

[5] R. Loos, 2012, Analytical methods relevant to the European Commission's 2012 proposal on Priority Substances under the Water Framework Directive, European Commission – Joint Research Centre (JRC), Institute for Environment and Sustainability (IES), Italy.

[6] European Union, Common implementation strategy of the water framework directive (2000/60/EC), 2014, Guidance document No. 33 on analytical methods for biota monitoring under the water framework directive, technical report 2014-084, Luxembourg.

[7] K. Deutsch et al., 2010, Leitfaden zur typspezifischen Bewertung gemäß WRRL, allgemein physikalisch-chemische Parameter in Fließgewässern, Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, Sektion VII, Wien.

The core parameters (oxygen content, pH value, conductivity, nitrate, and ammonium) to be analysed for the groundwater parameter assessment are listed in Annex V of the WFD. Additional groundwater parameters (e.g. heavy metals and pesticides), which are mandatory for compliant WFD groundwater monitoring, are laid down in the groundwater directive 2006/118/EC.[8] In addition, EU member states are responsible for defining the limit values of the corresponding groundwater parameters. In this case, the Austrian Quality Target Ordinance for Groundwater was used as a basis for limit values for the current groundwater parameter assessment.[9]

The assessment determines if the (WFD) parameter is within the scope of the analysis, is accredited according to ISO 17025 and the LOD and LOQ of the corresponding parameter. Moreover, it evaluates if the LOQs are compliant with WFD EQS values, current instruments and the methods used for analysis.

The assessed data will lead to an identification of actions such as method adaptation (e.g. when LOQs need to be reduced in order to comply with WFD-EQS values, ISO technical standards require implementation instead of national standards), method expansion (e.g. when the parameter is not yet in scope of analysis), the procurement of equipment and consumables and laboratory personnel training.

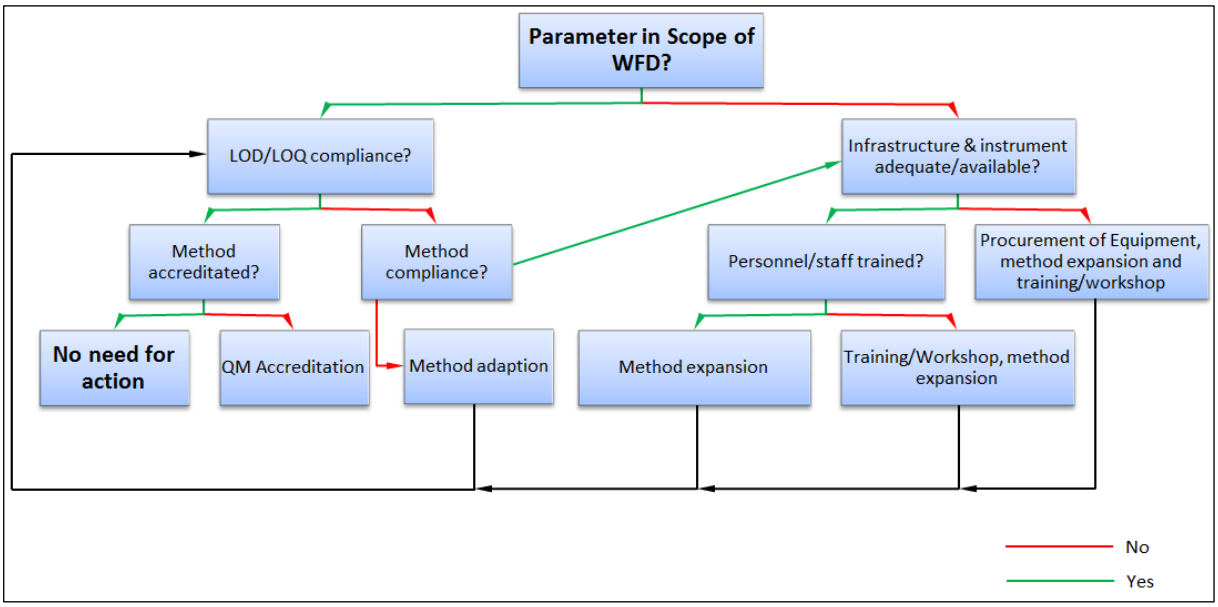

Figure 1: Flowchart illustrating the detailed hydro-chemical parameter assessment according to WFD requirements

[8] Directive 2006/118/EC of the European Parliament and the Council on the protection of groundwater against pollution and deterioration.

[9] BGB II Nr. 89/2010: Bundesgesetzblatt für die Republik Österreich, 2010, Qualitätszielverordnung Chemie Grundwasser, Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über den guten chemischen Zustand des Grundwassers.

5.2 Chronology

Two assessment missions took place and are summarised in the following chronology with the main assessment milestones.

Questionnaire during the inception phase:

- 1st laboratory assessment mission 3 – 7 July 2017
- 2nd laboratory assessment mission 2 – 4 August 2017 (

6 LABORATORY SELECTION

The laboratory for physical-chemical measurements at the Republican Centre of Analytical Control (RCAC) in the field of environmental protection in Minsk was nominated by the beneficiary at the kick-off meeting as the candidate laboratory for technical support under the EUWI+ project. Therefore, this laboratory was already visited during the inception phase and assessed in more detail during the assessment missions to Belarus. It will be the partner laboratory for co-operation.

The Country Representative of the EUWI+ project proposed the Central Laboratory of the Research and Production Centre for Geology (RPS), which is situated in the same building as the RCAC in Minsk, for in-depth assessment at a later stage. The technical support of this laboratory will not be the main priority, but staff members will be invited to participate in general training activities and proficiency testing schemes.

6.1 Laboratory at the Republican Centre of Analytical Control (RCAC) for physico-chemical measurements in the field of environmental protection

The Republican Centre of Analytical Control (RCAC) is a subordinated organisation of the Ministry of Natural Resources and Environmental Protection in the field of environmental protection. The RCAC is officially responsible for the regulatory hydro-chemical monitoring and analysis of surface water samples in the Republic of Belarus. The Centre includes 22 laboratories, three national, five oblast and 14 interregional laboratories. Technical support will be given to the laboratory for physico-chemical measurements by the RCAC in Minsk.

The laboratory staff of the RCAC's physical-chemical measurement laboratory consists of six persons, four technical and two management employees, all of whom have a university degree in chemistry or biology. Surface water monitoring at RCAC is well established and a number of WFD-relevant testing methods for water and sediments have already been accredited (acc. to EN/ISO IEC 17025:2005) by the Belarusian State Centre for Accreditation (BSCA) and among these are numerous priority substances. The current accreditation certificate is valid until September 2021 and includes all of the Centre's 22 laboratories. Surface water monitoring is carried out in all the laboratories, while two laboratories also analyse sediments. 21 laboratories analyse discharge waters and monitor ground water around polluted sites and one laboratory is responsible for air quality monitoring. The accredited test methods for hydro-chemical water analysis in the RCAC's laboratory for physical-chemical measurements can be applied to surface, ground and used waters. The laboratory for physico-chemical measurements of the RCAC in Minsk is advanced, well equipped with adequate laboratory facilities and infrastructure, and has competent and motivated staff.

During the EUWI+ project, assistance with regard to method expansion and adoption for additional priority substances can be provided in addition to the purchase of new equipment, related spare parts and consumables (see chapter 7.1), quality management, technical training (see chapter 7.3) and further support for accreditation (participation in proficiency testing schemes), as well as the participation of laboratory personnel in study tours to EU member states (see chapter 7.2).

6.2 Central Laboratory of the Research and Production Centre for Geology (RPS)

The Research and Production Centre for Geology (RPS) is a subordinated organisation of the Ministry of Natural Resources and Environmental Protection. It has three laboratories with one for the determination of water age, one for the prospecting and extraction of oil at Mosir in the south of Belarus and a central unit for prospecting and researching into other mineral sources. The latter consists of one laboratory for the testing of water for several hydro-chemical parameters and one for testing minerals. It is located in Minsk in the same building as the laboratory for physico-chemical measurements in the field of environmental protection at the Republican Centre of Analytical Control (RCAC). In general, the laboratory facilities and infrastructure are adequate for the scope of analysis with a sufficient number of technical and managerial staff.

Until 2016, the central laboratory in Minsk analysed approximately 345 ground water samples from the national ambient groundwater monitoring system and was contracted by the Science and Production Centre of Geology, Institute of Geology. In 2017, no chemical analyses of water quality as part of the national, ambient groundwater monitoring system were carried out due to budgetary constraints and the need to allocate funds to the repair and maintenance of wells. Over the next three years, it is therefore planned to reduce chemical analysis to a very limited number of wells in trans-boundary catchments.

The Central Laboratory holds an ISO 17025 laboratory accreditation issued by the Belarusian State Centre for Accreditation (BSCA). The current accreditation certificate is valid until May 2021 with an accreditation scope covering eighteen priority substances.

Due to recent donations of numerous analytical instruments, there is no need for the procurement of a significant amount of additional equipment by the EUWI+ project. The involvement in the EUWI+ project will be limited to participation in selected technical and QM training (see chapter 7.3), the supply several small items of laboratory equipment and some support for accreditation (participation in proficiency testing schemes (see chapter 7.2).

7 ACTIVITIES

7.1 Activity 2.1.2 – Equipment procurement

Project activity 2.1.2 covers the procurement of new equipment, purchases of consumables and the rehabilitation and upgrading of existing equipment and laboratories to further enhance technical capacities. As indicated in the DOA, this activity focuses on long-term and sustainable capacity building. Based on the assessment results of the laboratories facilities and infrastructure, environmental conditions, equipment and consumables, a draft list for procurement (see Table 1) was drawn as a basis for technical support under activity 2.1.2.

7.1.1 RCAC laboratory for physical-chemical measurements

The procurement of analytical equipment and consumables is recommended for the following WFD parameters, in order that the EQS and LOQs of the WFD can be met. The following table was drawn up as a result of the findings of the laboratory assessment missions in Belarus, as well as the desired support mentioned by the beneficiary. It should be noted that this table represents a preliminary result of the identified needs for consumables and equipment, and will be subject to additional, minor adjustments.

Part of the technical specifications of the tendering documents for new analytical instruments will also involve suitable PCs and software for the laboratory workplace, as well as successful on-site installation, the verification of technical specifications in combination with specific training provided by the manufacturer, and a service contract for the duration of the EUWI+ project to guarantee sustainability of the action.

Table 1: Suggested list for procurement of equipment and consumables

Substance name/parameter	Equipment & consumables	Estimated costs
Equipment List		
Volatile organic compounds (VOC): Benzene, carbon tetrachloride, trichloroethylene, tetrachloroethylene, 1.2-dichloroethane, dichloromethane, trichlormethane	Headspace autosampler compatible with the GC/MS procured from the SAQEM project	€ 20,000
PAH: benzo(a)pyren, benzo(b)fluoranthen, benzo(k)fluoranthen, benzo(g,h,i)-perylen, Indeno(1,2,3-cd)-pyrene Optional: perfluoroctanesulfonic acid (PFOA) and derivatives (PFOS), perfluoroctanesulfonic acid (PFOA) and derivatives (PFOS)	LC-DAD/FLD, optional with MS detector	€ 150,000
Mercury	Atomic fluorescence spectroscopy (AFS) for lower mercury quantification levels	€ 30,000
Sample preparation for the heavy metal analysis of water and sediments	Microwave digestion system with 2 sets of digestion PTFE vessels[10]	€ 35,000
Deionised water	Water purification system with cartridges	€ 20,000
Sample preparation	SPE for high volume (> 1L) sample extraction	€ 8,000

[10] PFTE vessels are required for Belarusian sample preparation methodology.

Substance name/parameter	Equipment & consumables	Estimated costs
Organochlorine pesticides	Shaker (orbital shaker with platform for dividing funnels up to 2 l) for automated LLE	€ 5,500
pH value	Portable equipment for on-site measurements including calibration buffers	€ 2,000
Conductivity	Portable equipment for on-site measurements with spare parts	€ 2,000
Dissolved oxygen	Portable equipment for on-site measurements with spare-parts	€ 2,000
Bottom sediments parameters	Grab sampler (3 L) for the selection and preliminary preparation of bottom sediment samples	€ 3,000
Sample preparation	Muffle furnace (min. 400 °C) for the reduction of blank values	€ 1,500
Water level, temperature	Water level and temperature recorder for groundwater wells (2x) near contaminated sites	€ 2,000
For sediment sampling and sample preparation on-site (sieving of the samples on-site)	Transport of sediment samples, material: PFTE Sampling buckets (10 L volume with broad neck) with 2 mm and 0,63 mm – 6x for each sieve	€ 2,500
Total (equipment)		**€ 283,500**
List of consumables		
PAH: benzo(a)pyren, benzo(b)fluoranthen, benzo(k)fluoranthen, Benzo(g,h,i)-perylen, indeno(1,2,3-cd)-pyren Optional: perfluoroctanesulfonic acid (PFOA) and derivatives (PFOS), perfluoroctanesulfonic acid (PFOA) and derivatives (PFOS)	HPLC column and guard column, SPE kits and cartridges	€ 4,000
Sample preparation	1-10 µL, 10-100 µL, 100-1000µL single channel adjustable pipettes and corresponding tips	€ 1,500
Alkyl- and arylphenols: nonylphenol (4-nonylphenol), 4-tert-octylphenol, pentachlorophenol Volatile organic compounds (VOC):[11] Benzene, carbon tetrachloride, trichloroethylene, tetrachloroethylene, 1.2-dichloroethane, dichloromethane, trichloromethane Phthalates: 1,2- Bis(2-ethyl-hexyl)phthalate (DEHP) no Sn-antifouling products used in BY	Reference standards for priority substances where the method has to be adapted	€1,500
Priority 2: Parameters[12] to be analyzed under ISO 6468: Alachlor, Hexachlorbutadiene, Dicofol, Aclonifen, Bifenox Priority 2: Parameters[12] to be analyzed under ISO 10695: Chlorfenvinphos, Chlorpyrifos (Chlorpyrifos-Ethyl), Diuron, Cybutryn, Cypermethrin, Dichlorvos, Terbutryn	Purchase of chemical reference materials for the expansion of current analytical methods	€ 1,000
Perfluoroctanesulfonic acid (PFOA) and derivatives (PFOS), (BY: approved methodology), Quinoxyfen, diuron, isoproturon, simazine (BY: not approved methodology),	Purchase of chemical reference materials for the expansion of current analytical methods	€ 1,000
Mercury	Reference standards for AFS	€ 250

[11] Prerequisite: headspace autosampler is already installed at GC/MS on-site.

[12] These parameters and/or methodology have not yet been introduced into Belarusian legislation.

Substance name/parameter	Equipment & consumables	Estimated costs
EN ISO 11423[13, 11], EN ISO 25101, EN ISO 17943	Technical standard methods (ISO, EN) for determination of priority substances	€ 150
Total (consumables)		**€ 9,400**
Total (equipment and consumables for Belarus)		**€ 292,900**

7.2 Activity 2.1.3 Technical support of laboratories for accreditation

7.2.1 RCAC laboratory for physical-chemical measurements

As the RCAC already holds an EN ISO/IEC 17025 accreditation for testing laboratories with an appropriate quality management system, the support under this activity will focus on:

Table 2: Planned activities for RCAC

Topic	Timeline	Costs
Participation in proficiency testing schemes (PTS) for water analysis for selected groups of parameters Programme: https://www.eptis.bam.de/eptis/WebSearch/main http://www.umweltbundesamt.at/en/services/laboratory_services/interlaboratory_comparison/ic_wateranalysis/	Two different rounds of PTS: one participation in 2018, the second in 2020	€ 2,500
Study visit to selected laboratories and administrative bodies of the consortium partners by at least two laboratory staff members	2019	--

All training is summarised under Activity 2.2.1.

7.2.2 Central Laboratory of the Research and Production Centre for Geology (RPS)

The following implementation steps are planned:

Table 3: Planned activities for RPS

Topic	Timeline	Costs
Participation in proficiency testing schemes (PTS) for water analysis for selected groups of parameters Programme: https://www.eptis.bam.de/eptis/WebSearch/main http://www.umweltbundesamt.at/en/services/laboratory_services/interlaboratory_comparison/ic_water analysis/	One round of PTS: one participation in 2018, the second in 2020	€ 1,250
Study visit to selected laboratories and administrative bodies of the consortium partners by at least one laboratory staff member	2019	--

All training is summarised under Activity 2.2.1.

[13] Deleted EN ISO standards are either already existent as STB ISO standards, or it is not planned to switch to corresponding ISO methods in the near future.

7.3 Activity 2.2.1 Training

This activity deals with the preparation of training plans and the organisation of hands-on training and trainer training with regard to monitoring and laboratory analyses, as well as the support of laboratories for accreditation, as indicated in the DOA.

The following training needs were identified as a result of visits during the inception phase and the in-depth analysis of the current status of the technical capacity of the laboratories. Efforts were made to differentiate between hands-on training directly in the laboratory premises using both existing equipment and the equipment to be purchased in the course of the project, and more general training, which can be held independently.

The dates indicated are preliminary and subject to the availability of MS experts, BC experts and coordination with other project activities.

7.3.1 Equipment-dependent training at RCAC

Existing equipment – method expansion & adaption

The existing GC/MS is outdated, and its detector sensitivity may be insufficient to achieve the EQS-values for surface water required by the WFD. Therefore, the originally planned training for method expansion with the existing GC/MS instrument will not be carried out. This is a result of the discussions held during the agreement mission in Minsk on 28 March 2018. Instead, at the earliest the training will be carried out with the new GC/MS in 2019, although this depends upon the successful registration of the EUWI+ project in Belarus. The beneficiaries expressed their desire for training abroad, e.g. for selected participants from the RCAC in Minsk at the laboratory of the Environment Agency Austria.

New equipment – method expansion & adaption

For the equipment procured under activity 2.1.2 method validation is planned after successful installation and test runs for the following groups of compounds and related ISO standard methods indicated in Table 4:

Table 4: Suggested implementation of parameters with new equipment

Priority	Substance name/parameters	Comment (suggested techn. ISO standard)	Method description	Proposed dates
1	Carbon tetrachloride, trichloroethylene, tetrachloroethylene, 1.2-dichloroethane, dichloromethane, trichloromethane[11]	EN ISO 10301	LLE with n-hexane and detection by HS-GC-MS	Q2/2019
1	Benzene[11]	EN ISO 11423	Direct detection by HS-GC-FID or HS-GC-MS	Q2/2019
1	Bis(2-ethyl-hexyl)phthalat (DEHP)[14]	ISO EN 18856	C18-SPE and detection by GC-MS	Q1/2019
1	4-tert-octylphenol, nonylphenol (4-nonylphenol[14]	EN ISO 18857-1	LLE with toluene and detection by GC-MS	Q3/2019

[14] According to the description of action (DoA) the hands-on method of training is foreseen as being conducted directly in the beneficiary laboratory. However, the beneficiary suggested that selected training at the Umweltbundesamt laboratory premises might be considered, as the project registration process is yet to be completed, which has caused a delay in the procurement of equipment for training (see also section 7.1).

Priority	Substance name/parameters	Comment (suggested techn. ISO standard)	Method description	Proposed dates
2	Pentachlorophenol[14]	EN ISO 12673	Derivatisation with acetic anhydride, extraction with n-hexane and detection by GC-MS	Q4/2019
1	PAH: benzo(a)pyren, benzo(b)fluoranthen, benzo(k)fluoranthen, benzo(g,h,i)-perylen, Indeno(1,2,3-cd)-pyren	EN ISO 17993	LLE with n-hexane and detection by HPLC-FLD	Q4/2019
1	Mercury	EN ISO 17852	Digestion with bromine and detection by AFS	Q3/2019
2	Perfluoroctanesulfonic acid (PFOA) and derivatives (PFOS)	EN ISO 25101	SPE-LC/MS	Q4/2019

7.3.2 General training for laboratory personnel

The participation of representatives of partner laboratories is covered by the project. Training with more generic topics may also take place in regional workshops, enabling an additional exchange of experience and strengthening trans-boundary cooperation between EaP countries. General training is also open to other participants, who may attend on their own expense.

- **Training for QA/QC and method validation (Q1/2018**)
  - Method validation (LOD, LOQ, measurement uncertainty)
  - QA/QC measures (e.g., blank values, control samples, recoveries)
  - Use of control charts
  - Improvement of LOQ
  - Metrological traceability
- **ISO 17025: 2017 new revision** – Training regarding new, changed requirements and an exchange of experience for implementation (Q4/2018 at the earliest, or Q1/2019)
- **Training for internal auditors based on the ISO 19011** guideline for auditing management systems and specific requirements of the ISO 17025 (Q3-4/2018)
- **Training on WFD analytical methods by WRI/Bratislava, planned for the end of September 2018 for two Belarusian specialists**
- **2-day (on-site) training for 7-10 participants on sediment sampling based on ISO 5667-1 (sampling programmes) and ISO 5667-12 (bottom sediments from lakes and rivers) planned for June/July 2018**
- **For this training, a preparatory mission is planned in May 2018 (on-site sampling assessment, documentation of sampling equipment)**

8 RELATED ISSUES

Within the context of the assessment, a number of issues were identified that fall outside the initial scope of the assessment objectives.

8.1 Import regulations

According to information provided by RCAC, the Belarusian import regulations are very strict, not only for analytical equipment, but also with regard to the various chemical standards necessary for proper QA/QC measures in the lab. This fact may limit the technical support and timely delivery of certain activities.

9 INSTITUTIONAL SUSTAINABILITY OF SELECTED LABORATORIES

As the Republic of Belarus is a non-association agreement country, it is not obliged to ensure that its legal and policy framework complies fully with WFD principles. Reference was made to harmonisation with EU directives, or alignment with the principles of directives contained in the 2015 Water Code. In particular, the secondary legislation for its technical application still needs to be adopted for priority substances. The amendment is envisaged for 2020.

The RCAC is a subordinated institution of the Ministry of Natural Resources and Environmental Protection and the competent authority for the regulatory hydro-chemical monitoring and analysis of surface water samples in the Republic of Belarus. With its 22 laboratories distributed across the country and headquarters in Minsk, a clear organisational structure, a regular financial planning process with the ministry with an annually approved budget that also covers flexible costs, a sufficient number of managerial and technical staff and an EN ISO/IEC 17025 laboratory accreditation for the whole Centre, the institutional framework has a solid basis. In addition to the regulatory tasks for the Ministry of Natural Resources and Environmental Protection, the RCAC provides monitoring work for enterprises on a contractual basis.

The physical-chemical measurement laboratory of the RCAC in Minsk, which will be the partner laboratory in the EUWI+ East project, already has a high technical capability, is well equipped with adequate laboratory facilities and infrastructure, and possesses competent and motivated staff. The planned activities and technical support by the EUWI+ east project constitute an important step towards WFD compliant monitoring. However, there are still numerous aspects that need to be addressed and implemented using a stepwise approach in a mid- or long-term phase beyond the project period.

10 RECOMMENDATIONS AND STRATEGIC OUTLOOK

During this assessment, both the technical and institutional issues at a few selected laboratories were evaluated with the aim of preparing a vision/development path for these bodies towards WFD compliant monitoring. These paths/visions were formulated in the light of the available financial and human resources and with a view to ensuring their sustainable operation. With this in mind stages were identified, which can be implemented in sequence while safeguarding the sustainability and operation of the deliverables.

The full implementation of the vision exceeds the scope of the project and requires more time and additional resources. The authors recommend a development path for the selected laboratories for a period of 10-15 years as follows:

- **Build up of technical capacity at RCAC** for the determination of priority substances (brominated diphenylethers, dioxins, hexabromocyclododecane (HBCDD)) using gas chromatography with mass selective high resolution techniques (**GC-HRMS**)
    - Preconditions: high investment costs, high operating costs, need for additional appropriate laboratory rooms (highly sensitive equipment, very good environmental conditions required), specially qualified laboratory staff (ideal PhD in organic chemistry and experience in methodology)
    - In many European countries this kind of analysis is contracted out by the national authorities to third party laboratories in the market, should the national laboratories for water quality monitoring not have the technical capabilities needed.
- **Development of environmental quality standards (EQS) for biota**
    - Differing biological quality elements (BQE) such as macrophytes, phytobenthos, macro-invertebrates and fish are used for the assessment of the ecological status of water bodies. On the basis of these indicators and pressure impact relationships, ecological status classification systems (ESCS) have to be developed for the characterisation of the status of surface waters.
    - In terms of priority substances, scientific knowledge about the effects of pollutants in water has evolved significantly over recent years. More is known about which compartment of the aquatic environment, water, sediment or biota, a substance is likely to be found in, and therefore where its concentration is most likely to be measurable. Some very hydrophobic substances accumulate in biota and are hardly detectable in water even using the advanced analytical techniques. For such substances, environmental quality standards (EQS) should be also set for biota such e.g. fish.

11 NEXT STEPS

With respect to this report the following steps need to be implemented:

- A review of the final draft assessment report by the beneficiaries, nomination of co-author(s)
- The start of the preparation of procurement documentation (see section 7.1);
  project registration is a prerequisite for tendering
    - Drafting of technical specifications for the new equipment by the beneficiaries in-line with WFD requirements in the English language
        - A template for the technical specifications will be provided by the MS experts and sent to the laboratories to be completed. The basis is formed by the preliminary list of equipment under section 6.1. for each laboratory
        - A review and amendment of the technical specifications by Environment Agency Austria experts; clarification of open issues (if any) with the beneficiary laboratories
        - Submission of the final technical specification documents to a law firm, which will be contracted under the EUW+ east project to carry out the EU compliant tendering procedure
    - Purchase of consumables
        - Will be purchased separately from laboratory equipment and on demand
- Planning of technical support to the laboratories (see section 7.2)
- Planning of training activities (see section 7.3)

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