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

AUDIT REPORT

GROUNDWATER SAMPLING ARMENIA

Funded by
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ABOUT THIS REPORT

AUTHORS(S)

Franko Humer, Environment Agency Austria (UBA)

Andreas Scheidleder, Environment Agency Austria (UBA)

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Owner and Editor: EU4Environment-Water and Data Consortium

Umweltbundesamt GmbH	Office International de l'Eau (IOW)
Spittelauer Lände 5	21/23 rue de Madrid
1090 Vienna, Austria	75008 Paris, FRANCE

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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
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
EPIRB..... Environmental Protection of International River Basins
ESCS ..... Ecological Status Classification Systems
EU ..... European Union
EUWI+..... European Union Water Initiative Plus
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
NESB ..... National Executive Steering Board
NFP ..... National Focal Point
NGOs..... Non-Governmental Organisations
NPD..... National Policy Dialogue
OECD..... Organisation for Economic Cooperation and Development
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

RA ..... Republic of Armenia

SCWS..... State Committee on Water Systems

SWCIS..... State Water Cadastre Information System of Armenia

WRMA ..... Water Resources Management Agency

1. Scope

Whenever a volume of water – in terms of groundwater, a groundwater body – is to be characterized, it is generally impossible to examine the whole volume and it is therefore necessary to take samples. Because one single sample – often 1 liter or even less – should represent volumes of thousands of liters of groundwater, qualified collection of samples is of utmost importance.

Since the repetition of whole sampling tours is mostly impossible and the comparability of data is otherwise not guaranteed at all, errors made during sampling cannot be repaired.

Therefore, the whole procedures of sampling – beginning with the preparation and planning, followed by the technical implementation in the field and ending with the documentation, the handover of the samples, as well as the cleaning and maintenance of the equipment – should be qualified processes.

The groundwater sampling audit aimed to assess whether the requirements of the ISO (International Organization for Standardization) standards and the EU Water Framework and Groundwater Directives to monitor groundwater are followed.

From 2nd to 4th October 2023 experts from the Hydrometeorology and Monitoring Center of Armenia (HMC) took part in an on-site training on quality assurance aspects during the groundwater sampling of the transboundary groundwater survey between Armenia and Georgia (AM-GE). The training given by international experts of Umweltbundesamt Austria covered theoretical aspects, routine sampling procedures from preparation and planning of a sampling tour, calibration of field equipment and taking samples in the field. The qualified handover of samples to the laboratory was no part of this sampling audit. The international experts observed the national colleagues during their routine work .

This report reviews the sampling procedures observed, summarizes the observations and gives suggestions where further improvments in the quality of sampling can be achieved. Therefore, the report serves as a first step of sampling certification, even as a basis for future accreditation in the field of (ground)water sampling.

2. Activities performed

On 2nd October 2023 international experts of the Umweltbundesamt met AM groundwater experts at HMC in Yerevan to observe the preparation of the sampling equipment. The focus of the preparation was on the check for completeness of the sampling equipment and the calibration of the field devices.

According to the information of the groundwater experts the field devices are used every day, calibration is done every second week. The calibration of the field device was done in the office on the day before the planned sampling tour by groundwater experts of HMC.

The used measurement system YSI ProDSS is a multiparmetric device equipped with three sensors for conductivity, pH-value and oxygen content incuding water temperature. All replaceable sensors are installed in a 4-port bulkhead protected by a sensor guard.

The pH-sensor was calibrated with one time HACH Lange GmbH buffer solutions in 20 ml bags, the electrical conductivity sensor with one time 1413 µS/cm standard solution from HACH Lange GmbH. The solutions were brought along from Germany within another project. The buffer solution bags had no expiry date. Calibration of the oxygen sensor was done in saturated air in the delivered transport device. Within the calibration process, the manual of the device was consulted, supported by practical input of the experts of Umweltbundesamt.

On 3rd October two monitoring sites were sampled in Georgia near the border during the transboundary groundwater sampling AM-GE, followed by two sites at the border in Armenia on the 4th October.

Because the two monitoring sites in Georgia were representes by flowing springs, no pump was needed.

The first monitoring site in Armenia could not be sampled due to the low groundwater level in combination with a not fully functional pump. The second monitoring site in Armenia was so close to the border that no international expert was allowed by the border military to accompany the Armenian experts to the well. The experts of HMC performed the groundwater sampling at this monitoring site, but the experts of Umweltbundesamt could not observe these activities.

3. Recommendations

Based on the observations gathered before, during and after the transboundary groundwater survey AM-GE, the following aspects and activities are highly recommended to be considered in future groundwater sampling activities:

- Checklists for checking completeness of the needed equipment are highly recommended.
- Proof of technical functionality of the equipment should be done and documented before a sampling tour. On 2nd October the international experts of Umweltbundesamt observed an obviously broken pump. The experts of HMC fixed this issue before the beginning of the survey in an amazingly professional way. Nevertheless the proof of functionality was not made by submerging the pump in water in advance to the survey. This should be done before the survey at least in a bucket.
- Calibration of the equipment was done with one time buffer or standard solutions in small bags for only one calibration procedure. Within a regular monitoring this is not practical and relatively expensive compared to technical buffer solutions in larger packages. Nevertheless, the buffer solutions extracted from larger packages should only be used one time.
- Buffer solutions have an expiry date after which they must not be used anymore. Use buffer solutions only one time and dispose them properly after this single use.
- The buffer solutions should be stored in an appropriate place, ideally in the laboratory under controlled conditions.
- It is recommended to coordinate with the laboratory if a technical buffer solution is still usable. Ideally the buffer solutions come from the laboratory.
- Be aware to use the correct buffer or standard solutions that are allowed by the used measurement system or field devices. Check the manual in advance.
- The frequency of calibration is set manually and is usually indicated by blinking electrodes in the display of the field device.
- It was noted on 2nd October that the last calibration (saved in the device) was made in July 2023. Therefore it is obvious that calibration was not done every second week. It is highly recommended to write these calibration data into a specific book or digital file each time, because such a documentation can help detecting at an early stage when a sensor is ageing. A calibration workshet can be found even for the used ProDSS device (https://www.ysi.com/File%20Library/Documents/Guides/W87_YSI_ProDSS_Calibration_Worksheet.pdf).
- Cooling batteries (thermal packs) have to be stored frozen in advance. Only frozen cooling batteries provide sufficient cooling of the samples.
- Avoid direct contact of frozen cooling batteries with the bottles. Put e.g. paper or cardboard between the bottles.
- If possible, use two cooling boxes, one box with the empty bottles that need not be cooled and one box with the taken samples that is cooled the whole time. Open the cold cooling boxes only for inserting samples.
- Control the temperature in the cooling boxes several times during the day. Ideally, the temperature inside the cooling box should be the same as the temperature of the sampled groundwater.

- The measurement of the onsite parameters should be done in the flowing water at the site itself (and not in water which was taken from the sites and stands in a bucket), to reflect the natural conditions especially of oxygen content and water temperature.
- Before measuring and noting the values at the devices in the sampling protocol, wait until the values are stable.
- Organoleptic parameters (taste, odour) should be observed in reality at the sampling site. These parameters should be added into the sampling protocol only after they have actually been controlled.
- Next to the bottles also the caps of the bottles should be rinsed before filling the bottles.
- Compare the measured data of your second electrical conductivity device (ORION model 122) with the measurements of the ProDSS. The ProDSS – if calibrated correct – should give you the real and therefore better values.
- Use checklists for cleaning and maintenance of the whole equipment. These checklists should ideally contain the signature and the time by whom and by when the equipment was cleaned or maintained.

4. Summary

The overall impression of these three days of observation is that the groundwater experts of HMC are highly motivated and have high expertise in the procedures of groundwater sampling. It was noted that information about correct calibration of field devices given during the data interpretation workshop in February 2023 were taken into account and correctly implemented for the preparation of the transboundary survey in October 2023.

Other aspects like testing the functionality of the equipment under real conditions were rather new and need to be taken into account and included in routine work.

However, if the above recommendations will be implemented and the previous high quality activities continue to be applied in the same high quality way, the quality of the already good groundwater sampling will continue to improve and ensure representative samples according to international standards.

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