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Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe

Working Group on Effects

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Progress in activities of the Working Group on Effects in 2024 and future work: air pollution effects on materials, the environment, and crops: air pollution effects on waters

Effects of air pollution on rivers and lakes

Report of the Programme Centre of the International Cooperative Programme on Assessment and Monitoring of the Effects of Air Pollution on Rivers and Lakes

Summary

The present report is submitted for consideration by the tenth joint session of the Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe and the Working Group on Effects, in accordance with both the 2022-2023 and 2024–2025 workplans for the implementation of the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/148/Add.1, workplan item 1.1.1.12; ECE/EB.AIR/154/Add.1, workplan items 1.1.1.11 and 1.1.1.12) and the revised mandate for the International Cooperative Programme on Assessment and Monitoring of the Effects of Air Pollution on Rivers and Lakes (Executive Body decision 2019/15).

The report is a progress report on activities, including a summary of the discussion and results presented at the fortieth of the Task Force of the International Cooperative Programme on Assessment and Monitoring of the Effects of Air Pollution on Rivers and Lakes which was held jointly with the Task Force of the International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems (Czechia, 28-30 May 2024).

I. Introduction

1. The present report of the International Cooperative Programme on Assessment and Monitoring of the Effects of Air Pollution on Rivers and Lakes (ICP Waters) is submitted for consideration by the tenth joint session of the Steering Body to the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) and the Working Group on Effects, in accordance with both the 2022-2023 and 2024–2025 workplans for the implementation of the Convention on Long-range Transboundary Air Pollution (ECE/EB.AIR/148/Add.1, workplan item 1.1.1.12; ECE/EB.AIR/154/Add.1, workplan items 1.1.1.11 and 1.1.1.12) and the revised mandate for the International Cooperative Programme on Assessment and Monitoring of the Effects of Air Pollution on Rivers and Lakes (Executive Body decision 2019/15)[1]. The report is a progress report on activities, including a summary of the discussion and results presented at the fortieth meeting of the ICP Waters Task Force which was held jointly with the Task Force of the International Cooperative Programme on Integrated Monitoring of Air Pollution Effects on Ecosystems (ICP Integrated Monitoring) (Czechia, 28-30 May 2024).

2. The lead country of the ICP Waters Task Force is Norway. The Programme Centre of ICP Waters is hosted by the Norwegian Institute for Water Research. ICP Waters' national focal centres contribute with data and present national results related to assessment and monitoring of air pollution effects on surface waters. ICP Waters collaborates with all the International Cooperative Programmes under the Working Group on Effects, as well as the Joint Task Force on the Health Aspects of Air Pollution, which is a joint body of the World Health Organization (WHO) European Centre for Environment and Health and the Executive Body for the Convention on Long-range Transboundary Air Pollution. ICP Waters also collaborates with other bodies of the Convention where relevant, such as the Meteorological Synthesizing Centre - West (MSC-W).

3. The ICP Waters monitoring network is tailored to monitor effects of air pollution on surface waters and currently consists of more than 500 sites in acid-sensitive areas in more than 20 countries in Europe and North America. The rivers and lakes are sampled regularly under national monitoring programmes. The data series often start during the 1990s, while some sites have over 40 years' worth of data. Data calls are issued regularly, and the data are used in assessments of trends and spatial patterns.

4. The fortieth meeting of the ICP Waters Task Force was also the seventh joint meeting with the ICP Integrated Monitoring Task Force. It was a hybrid meeting, held in Prague, Czechia, and was attended by 48 experts from 17 Parties to the Convention. Currently, 25 countries participate in one or more of the activities of ICP Waters. The ICP Waters Task Force considered progress reports from the Programme Centre and the national focal centres on the results on biodiversity, acidification, dynamic modelling, NEC Directive, heavy metals and other WGE relevant issues. The presentations are available from the ICP Waters home page[2] and are summarized in the minutes.[3] Highlights from the presentations and discussions at the meeting are presented below (section VI).

II. Outcomes and deliverables during the reporting period

5. During the reporting period, ICP Waters produced or contributed to the following publications and reports:

(a) The 2023 joint progress report on policy-relevant scientific findings of the EMEP Steering Body and the Working Group on Effects (ECE/EB.AIR/GE.1/2023/3−ECE/EB.AIR/WG.1/2023/3). The report contains information on data, activities and results generated by ICP Waters;

[1] Available at www.unece.org/env/lrtap/executivebody/eb_decision.html.

[2] See http://www.icp-waters.no

[3] The minutes of the Task Force meetings, which include the agenda, the list of participants and the workplan, are available at www.icp-waters.no/meetings.

(b) A report on progress in activities by ICP Waters (ECE/EB.AIR/GE.1/2023/INF.8−ECE/EB.AIR/WG.1/2023/INF.8);

(c) Contribution to the EMEP and WGE 2024 Joint progress report on policy-relevant scientific findings (ECE/EB.AIR/GE.1/2024/3−ECE/EB.AIR/WG.1/2024/3);

(d) The reports on the thirty-seventh chemical intercomparison[4], the twenty-seventh biological intercalibration[5] and the report on trends in surface water chemistry (2022–2023 workplan item 1.1.1.12)[6]. The work on water chemistry trends based on data from the ICP Waters database including a new call for data was started in 2022. This work continued through 2022 and 2023 and the report was published early 2024.

6. During the reporting period, ICP Waters participated in the following meetings under the Convention: the ninth joint session of the Steering Body to EMEP and the Working Group on Effects (Geneva, September 2023); the Extended Bureaux meeting of those two bodies (Geneva February-March 2024); the fortieth meeting of the Task Force of the International Cooperative Programme on Modelling and Mapping of Critical Levels and Loads and Air Pollution Effects, Risks and Trends (ICP Modelling and Mapping) and the thirtieth Coordination Centre for Effects (CCE) workshop (Oslo, 2024); the fortieth meeting of the Task Force of the International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (online, June 2024). ICP Waters have also participated in two online meetings (August 2023 and May 2024) on input to an e-learning course on effects-related work under the Convention.

7. Preparatory work on the open data policy has continued. A permission request to publish ICP Waters chemical data under a creative commons license has been sent out to the national focal centres.

III. Expected outcomes and deliverables for the next reporting period and in the longer term

8. In the second half of 2023, ICP Waters carried out, and will continue to carry out in 2024, the following activities, in accordance with the 2024-2025 workplan for the Convention, the ICP Waters mandate and with the decisions taken at the fortieth meeting of the Task Force:

(a) Finalise the update of the ICP Waters manual (ECE/EB.AIR/GE.1/2023/6-ECE/EB.AIR/WG.1/2023/6, 2024-2025 workplan item 1.1.1.11). This work was started in 2022 and is expected to be finalised by the end of 2024. A revision team has been working on restructuring and updating the content. A draft was distributed before the fortieth meeting of the Task Force, and further discussed there;

(b) Initiate the work on dose-response relationships between water chemistry and biology, as discussed at the fortieth meeting of the Task Force in 2024. A thematic report on this topic is planned to be finalised in 2025 (ECE/EB.AIR/GE.1/2023/6-ECE/EB.AIR/WG.1/2023/6, 2024-2025 workplan item 1.1.1.12);

(c) Arranging the thirty-eight chemical intercomparison and the twenty-eight biological intercalibration;

[4] Tina Bryntesen, “Intercomparison 2337: pH, Conductivity, Alkalinity, NO3-N, Cl, SO3, Ca, Mg, Na, K, TOC, Tot-P, Tot-N, Al, Fe, Mn, Cd, Pb, Cu, Ni, and Zn”, ICP Waters Report No. 154/2023 (Oslo, Norwegian Institute for Water Research (NIVA), 2023). Available at www.icp-waters.no/publications/.

[5] Christian Lucien Bodin and others, “Biological intercalibration: Invertebrates 2023”, ICP Waters Report No. 155/2024 (Oslo, NIVA, 2024). Available at www.icp-waters.no/publications/.

[6] Rolf D. Vogt and others, “Trends and patterns in surface water chemistry in Europe and north America between 1990 and 2020, with a focus on calcium”, ICP Waters Report No. 156/2024 (Oslo, NIVA, 2024). Available at www.icp-waters.no/publications/.

(d) Arranging the forty-first meeting of the ICP Waters Task Force and 8th joint meeting with ICP Integrated Monitoring;

(e) Report on activities to the eleventh joint session of the Steering Body to EMEP and the Working Group on Effects;

(f) Attending meetings inside and outside the Convention, for instance, to support the monitoring and reporting under the European Union National Emission Ceilings (NEC) Directive[7], LTER Europe and the Minamata Convention on Mercury;

(g) Prepare for publication of ICP Waters chemical data, visualize the chemical data on the ICP Waters homepage and initiate work on a data paper.

(h) Contribute to the revision of the Gothenburg Protocol by evaluating suggested emission reduction scenarios in terms of effects on aquatic ecosystems.

(i) Develop assessment topics for the 2026-2027 workplan, to be discussed at the forty-first meeting of the Task Force.

(j) Start upgrading the database on biological data.

IV. Cooperation with other groups, task forces and subsidiary bodies, including with regard to synergies and possible joint activities

9. ICP Waters has focused on synergies with other bodies and groups under the Working Group on Effects. The Task Force meeting has been held jointly with ICP Integrated Monitoring from 2016 onwards, to mutual satisfaction. There is regular collaboration on thematic reports with ICP Integrated Monitoring and with other bodies under the Convention.

10. The involvement of countries in Eastern and South-Eastern Europe, the Caucasus and Central Asia in ICP Waters work currently includes participation of Armenia, the Republic of Moldova and the Russian Federation. Armenia participated at the fortieth meeting of the Task Force of ICP Waters and presented their work.

V. Scientific and technical cooperation with relevant international bodies

11. ICP Waters supports the development of the European Long-Term Ecosystem Research (eLTER). Also, ICP Waters follows the ongoing processes under the NEC Directive and aims to participate in relevant meetings.

VI. Highlights of the scientific findings: policy-relevant issues

12. *Revision of the Gothenburg Protocol*. The revision of the Gothenburg Protocol is an important item on the agenda for the Air Convention. Changes in biodiversity and exceedances of critical loads are important indicators of ecosystem effects that are relevant to this process. Acidification of surface waters has led to loss of salmon populations and other sensitive fish species, and loss of species in other organism groups such as macro-invertebrates and epilithic diatoms. ICP Waters will contribute to document effects of air pollution reduction policies on surface waters, to assess whether these policies have their intended effect. For instance, linking exceedances of critical loads to ecosystem effects may be a topic worthy of more attention. Moreover, dynamic modelling can be applied to model future water chemistry given suggested emission scenarios and evaluate possible consequences for biological recovery.

[7] Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC, *Official Journal of the European Union*, L 344 (2016), pp. 1–31.

13. Chemical recovery. Surface waters in Europe and North America show strong chemical recovery in the period 1990 to 2020. In the past decade, chemical recovery in Europe is levelling off while it is accelerating in North America, in agreement with air pollution trends. In less acidic and acidified sites neutral or increasing trends in calcium are observed, contrary to the decline in sulphate and the principle of electroneutrality. This is linked to increasing bicarbonate, which may be related to a climate-induced increase in weathering rates. Increasing weathering rates may lead to faster recovery. However, it is unclear whether weathering rates will increase at highly acid-sensitive sites, which have low weathering rates.

14. *Biological recovery and target ecosystem states under low acidification pressure*. National monitoring data, collated and assessed by ICP Waters, show that especially reductions in sulfur deposition lead to improved water chemistry and chemical recovery. However, it is unlikely that surface waters return to preindustrial conditions. Long-term depletion of base cations and enrichment with nitrogen will at best delay the chemical recovery, while climate warming and changes in land cover or vegetation will continue to change the water chemistry away from preindustrial conditions.

15. Similarly, biological recovery that is associated with chemical recovery is unlikely to follow a trajectory back to preindustrial conditions since source populations may be extinct and other factors than air pollution – mentioned above – have changed. Hence, the conditions under which a system can be regarded as recovered should be discussed, and target conditions defining a healthy ecosystem rather than assumed pre-industrial conditions may be more relevant. As a step towards defining these target conditions, chemical and biological time series will be examined in the context of existing thresholds. Time series will be analysed for step changes, lags in biological response and the levels at which conditions stabilise.

16. *Open data policy*. ICP Waters will promote open data sharing under the FAIR principles, by attribution license (CC BY). Only data that NFCs have agreed to give access to will be openly shared. A data paper, which users of the data can use as attribution, is under preparation.

17. *Air pollution and carbon emissions*. Carbon cycling in ecosystems is sensitive to air pollution. As an example, reduced air pollution has led to higher concentrations of dissolved organic matter and thereby also higher export of C from soils to surface waters, which could impact greenhouse gas emissions from freshwaters. National carbon budgets, quantifying changes in anthropogenic emissions and uptake of carbon in ecosystems, usually do not include carbon emissions from surface waters.

18. *Revision of the ICP Waters Manual*. The ICP Waters manual is undergoing revision and the revised document is expected to be useful within and outside the Convention, in particular for the NEC Directive

19. *Chemical intercomparison.* Results from the thirty-seventh chemical intercomparison were reported (see para. 5 (d) above). Twenty laboratories from 15 countries participated. Two sets of samples were prepared and distributed to the participants: one for the determination of ions and one for metals. This year, the method for assigning the acceptance criteria has been updated along with the implementation of a new statistical software. General trends in the choice of techniques are especially promising for the determination of metals at low levels. ICP Waters uses water samples with a substantial interannual variation in concentration levels, reflecting the variation found within the ICP Waters network. The chemical intercomparison is a valuable tool for quality assurance of laboratory analyses.

20. *Biological intercalibration.* Results from the twenty-seventh biological intercalibration of invertebrates were reported (see para. 5 (d) above). The goal was to evaluate the quality of, and harmonize, the taxonomic work. Four laboratories participated in 2023. The mean Quality assurance index (Qi) was 98.1 and 100.0, where 80 is the limit for good taxonomic work. Results in the biological intercalibrations over time suggest that the taxonomists in the laboratories affiliated to ICP Waters have good taxonomic skills.

VII. Publications

21. For a list of scientific papers from the ICP Waters network as well as ICP Waters reports, see the ICP Waters website.[8]

[8] See www.icp-waters.no/publications/.