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Working Group on Effects

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Recent results and updating of scientific and technical knowledge

Effects of air pollution on rivers and lakes

Report by the Programme Coordinating Centre of the International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Waters

I. Introduction

1. The work of the Programme Coordinating Centre of the International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Waters (ICP Waters) has recently focused particularly on the following key topics: (a) trends in surface water chemistry; (b) trends in aquatic biota and (c) revision of the ICP Waters Programme Manual. The results are presented here in accordance with item 3.3 of the 2011 workplan for the implementation of the Long-range Transboundary Air Pollution Convention (ECE/EB.AIR/106/Add.2), adopted by the Executive Body at its twenty-eight session in December 2010.

II. Workplan items common to all programmes

A. Report on the further implementation of Guidelines on reporting of monitoring and modelling of air pollution effects; trends, give information about parameters in the guidelines

2. Long-term records of surface water chemistry from 1990 – 2008 show that surface waters are recovering from acidification (decrease in sulphate and increase in pH, alkalinity and acid neutralizing capacity (ANC)) due to a decrease in sulphur emissions in Europe and North America. The recovery is weaker in the time spans 1999- 2008 than from 1990-1999.

The water quality is now sufficient for the return of acid sensitive fish-species, insects and shellfish. Some areas still show lack of chemical and biological recovery.

B. Ex-post analysis

3. The International Cooperative Programme on Assessment and Monitoring of Air Pollution Effects on Waters (ICP Waters) have actively participated in the ex-post analysis and contributed to the joint report with modelling future scenarios using the PRI, NAT2000 and NAT2020 scenarios. The results show that many aquatic ecosystems will recover from acidification under these scenarios. Highly sensitive sites will not recover even under MFTR scenario. However, uncertainties on the long-term storage and possible release of nitrogen compounds in river catchments and on the effects of climate change make forecasts difficult.

III. Acidification

4. A large analysis on trend analysis in water chemistry and biota has been performed for all sites in the ICP Waters programme. Water chemical trend analysis has been performed in nearly 200 acid sensitive monitoring sites in Europe and North America. The results show a consistent pattern of chemical recovery across a large number of these sites from 1990 up to 2008.

5. The trends in sulphate, pH, alkalinity and acid neutralizing capacity (ANC) give evidence of the chemical recovery of acidification. The recovery is weaker in the time spans 1999- 2008 than from 1990-1999.

6. Most sites show no significant trends in nitrate concentration. Regional trends have opposite signs or are insignificant (i.e., no consistent unidirectional trend), illustrating the multiple controls of nitrate leaching from catchments. The pattern is similar for both the time spans 1990-1999 and 1999-2008. The relative importance of nitrate for acidification of surface waters has increased in most regions because of the decreases in sulphate, but sulphate is still the far most important acidifying anion in acidified surface waters.

7. Results on biological monitoring from six countries (Czech Republic, Germany, Norway, Sweden and Switzerland) show that in some areas and for some species recovery is ongoing. However there are still areas acidified to a level where biological recovery cannot be expected, and other areas where recovery is incomplete. Six countries have reported results on trends in biological recovery.

8. The Czech contribution deals with zooplankton, benthic animals and macrophytes in Bohemian forest lakes, where all groups show positive response (recovery) in the later years. The response is particularly evident in the zoobenthos communities resulting in increased species diversity. These results are encouraging, as lakes in this region was some of the most severely acidified in Europe.

9. In Finland, fish population studies show that perch respond significantly to improved water quality conditions. More acid-sensitive fish species needs further chemical recovery and more time to recover.

10. German data shows that damage on biological communities due to acidification are still the case in Ore Mountains and Harz. Other areas less exposed to acidic depositions like the Black Forest and parts of the East-Bavarian basement, have the potential to reach stable, near natural conditions in the long run.

11. Biological recovery in Norwegian running waters has been documented for more than a decade. The water chemical recovery in Norway has resulted in both increased densities of acid-sensitive benthic animal species and a marked increase in biodiversity. There is however areas in southern Norway where biological recovery is still not observed or is incomplete.

12. In Sweden, water chemistry, phytoplankton, and littoral benthic invertebrate assemblage data from minimally disturbed (reference) lakes show signs of biological recovery. However, the changes are small. The Swedish study also shows that biological recovery is complex and the influence of climatic variability is poorly understood.

13. In Switzerland, recovery of benthic species could not be detected by time trend analysis. There are indications of a small number of new appearing species in some of the localities, but these appearances are still not significant. The Swiss time-series are short. It is therefore possible that some recovery has already occurred before invertebrate sampling started and that a future prolongation of the time-series will give significant responses.

14. Several areas in Europe will never achieve good (non-acidified) water quality with current legislation. Future reductions of both sulphur and nitrogen deposition would be necessary to achieve biological recovery not influenced by acidification. A return to pre-industrial biodiversity is unlikely in most cases, because original species are extinct, new species have been introduced and biological processes are complex.

IV. Cross-cutting issues

15. The revised and updated ICP Waters Programme Manual is now finished and printed and available on the web. The revised manual includes recommended methods for sampling water, lake sediments and aquatic biota related to effects of acidification, heavy metals and environmental pollutants.