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UNECE CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION – 40 YEARS OF ACTION FOR CLEANER AIR

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ABSTRACT: November 2019 marked the 40th anniversary of the adoption in Geneva of the Convention on Long-Range Transboundary Air Pollution, which aims primarily to reduce the damage to human health and the environment caused by air pollution. Over the years, the Convention has been extended by eight protocols that identify measures to control emissions of basic air pollutants. The efforts undertaken under the Convention have been instrumental in bolstering international cooperation to limit the pollution with sulphur and nitrogen oxides as well as to reduce emissions of other pollutants. The European Monitoring and Evaluation Programme (EMEP) has been developed complete with modelling and forecasting air pollution levels and pollutant fluxes. Robust information has been gathered in the EMEP databases. However, much remains to be done, and air pollution is still a challenge in the UN ECE region.

KEY WORDS: air pollution, air quality, international legislation, international agreement, regional convention

Introduction

2019 was the 40th anniversary of the adoption of the Convention on Long-range Transboundary Air Pollution (LRTAP Convention) – the first-ever internationally binding agreement addressing the damage to human health and the environment caused by air pollution (UN ECE, 1979). Despite the tense political situation in Europe in the seventies of the 20th century, the Convention set the framework for international cooperation, which was a major step in improving the air quality in the region.

Background of the LRTAP Convention

In the seventies of the 20th century, Europe was mostly concerned with the growing acidification of the environment. The pollutants such as sulphur and nitrogen oxides emitted by the industry, power production and transport were deposited on the ground as acid rain, while the emission source might have been located far from the deposition site, even in a foreign country. Acid rains were responsible for soil and surface water acidification and damage to ecosystems and affected human health, material corrosion, infrastructure and cultural heritage. The Scandinavian countries, where the detrimental effect of environmental acidification was particularly visible, raised this issue at the international level already in 1972 during the United Nations Conference on the Human Environment in Stockholm. In response to these problems, the European Economic Commission, one of the five regional UN commissions, which assembled the European countries, USA, Canada, Israel and the then Soviet Union (and now the majority of the states, which emerged after the collapse of the Soviet Union), initiated actions to achieve multilateral agreement to tackle the issue of air pollution and ever-growing acidification of the environment. These efforts culminated in approving the text of the Convention on Long-range Transboundary Air Pollution, which was adopted in Geneva on November 13, 1979, during a regional meeting on the protection of the environment. It was signed initially by 32 states of the UN ECE region, including Poland.

Goals and commitments

The general aim of the Convention has been and still is to control and reduce the damage to human health and the environment caused by air pollution. In the preamble, the Parties to the Convention emphasize the importance of establishing relations and cooperate to protect the environment and

recognize 'the existence of possible adverse effects, in the short and long-term, of air pollution' (including transboundary air pollution) as well as 'the need to study implications of the long-range transport of air pollutants and the need to seek solutions for the problems identified' (UN ECE, 1979). This means that the Parties to the Convention confirm their willingness to conduct and reinforce active multilateral cooperation to develop appropriate national policies and coordinate nationally undertaken efforts to combat air pollution. The Parties also undertake a commitment to conduct studies and monitoring as well as to exchange information and consultations. It is to be remembered that the text of the Convention was drawn in the seventies of the 20th century when Europe was still divided by the iron curtain and international cooperation was not an obvious thing. The ECE was then principally a unique forum for communication between Western Europe and the USA on one side, and the Eastern Bloc on the other. Thus, there are good reasons to value the cooperation in the past, the more that it yielded such positive results in the field of environmental protection.

The provisions of the Convention are of general nature and commit the Parties to take appropriate measures, among others, to:

- exchange information on and review their policies, scientific activities and technical measures aimed at combating the discharge of air pollutants (Art. 3),
- hold consultations in case of long-range transboundary air pollution episodes (or risk of such pollution episodes) (Art. 5),
- develop policies and strategies, which shall serve as a means of protecting the air quality including the air quality management systems, in particular by using the best available technologies (Art. 6),
- cooperate in the conduct of research (Art. 7),
- exchange available information on emissions data, meteorological, physicochemical and biological data relating to the process of transmission of long-range transboundary air pollution, data on control technologies for reducing air pollution as well as data on significant changes in policies for the air protection (Art. 8).

From the historical viewpoint, a milestone under the Convention was that the Contracting Parties (Art. 9) agreed to implement the 'Cooperative programme for the monitoring and evaluation of the long-range transmission of air pollutants in Europe' (EMEP), which over the past decades, enabled to establish the scientific base of the Convention. The Parties emphasized their willingness to join in its implementation, i.e. to conduct measurements, use standardized procedures for monitoring and data exchange, monitor the quality of other environmental media, such as water soil and vegetation as well as to develop national networks of EMEP monitoring stations.

Extension of commitments – protocols

The Convention entered into force in 1983 upon ratification by 24 states. Poland has ratified the Convention somewhat later, in 1985 (Journal of Laws 1985). Despite that its text contained no concrete arrangements concerning the emission abatement level (what then provided flexibility and facilitated participation of many countries), the developing cooperation succeeded fairly swiftly in the negotiation of eight subsequent protocols, including:

- Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (European Monitoring and Evaluation Programme, EMEP) (signed in 1984, entered into force in 1988), the so-called EMEP Protocol (UN ECE, 1984),
- Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent (signed in 1985, entered into force in 1987), the so-called Sulphur Protocol I (Helsinki Protocol) (UN ECE, 1985),
- Protocol concerning the Control of Nitrogen Oxides or their Transboundary Fluxes (signed in 1988, entered into force in 1991), the so-called Nitrogen Protocol (Sophia Protocol) (UN ECE, 1988),
- Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes (signed in 1991, entered into force in 1997), the so-called VOC Protocol (Geneva Protocol) (UN ECE, 1991),
- Protocol on Further Reduction of Sulphur Emissions (signed in 1994, entered into force in 1998), the so-called Sulphur Protocol II (Oslo Protocol) (UN ECE, 1994),
- Protocol on Heavy Metals and its 2012 amended version (signed in Aarhus in 1998, entered into force in 2003) (UN ECE, 1998a),
- Protocol on Persistent Organic Pollutants (POPs) and its 2009 amended version (signed in Aarhus in 1998, entered into force in 2003) (UN ECE, 1998b),
- Protocol to Abate Acidification, Eutrophication and Ground-level Ozone as amended on 4 May 2012 (signed in 1999, entered into force in 2005), the so-called Gothenburg Protocol (UN ECE, 1999).

Importantly, the first of the Protocols was instrumental in providing funds for the aforementioned EMEP study Programme, which aimed at the monitoring of air quality and pollutants fluxes. Owing to subsidies secured under the Protocol, the Programme has been sustainable and, with time, has developed to achieve the present status quo. Over time, this has resulted in a robust collection of information, and the picture of the regional air quality established based on this information could not be easily ignored and encour-

aged further actions. The latter, due to the nature of the problem, could not succeed unless with international cooperation.

The subsequent protocols set real commitments to reducing emissions of particular air pollutants. While the first protocols focused on acidifying pollutants, such as sulphur and nitrogen oxides, the subsequent protocols addressed other long-range airborne compounds, including volatile organic compounds, heavy metals, persistent organic pollutants and ultimately, the entire package of acidifying and eutrophying substances and tropospheric ozone precursors, incorporated in the ultimate protocol. The commitments to reducing the annual pollutant emission, being initially equal for all countries (30% reduction in sulphur oxides, provided for in the historical Sulphur Protocol I), became quickly differentiated depending upon conditions in a given state. As a baseline, the concept of critical loads was adopted, which is defined as the load of a pollutant 'below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge'. Moreover, the results were used of the integrated modelling intensively developed within the framework of the Convention. The assumption was to reach no exceedance of critical load levels by the individual states. Since the adoption of the Sulphur Protocol II, the binding annual emission reduction commitments have been defined as a percentage reduction of the value reported for the baseline year. In the 1999 Gothenburg Protocol, the values of permissible national annual emission (emission ceilings) were expressed as both the absolute values (in thousands of tonnes per year) and as the per cent emission reduction which should be achieved by 2010, compared to 1990 baseline year. The above values varied between states and pollutant types, e.g. they fluctuated between 0% (Armenia) and 90% (Germany) for SO_2. In addition to introducing the permissible national annual emission levels, the protocols have stepwise regulated permissible levels of emission from various categories of stationary and mobile sources, including industries, power generation and transport. Moreover, the contents of some pollutants in the products have been standardized.

The approach of the protocols was that they encourage not only the commitments to controlling and reducing pollutant emissions but also to studying and reporting measurement data collected and formatted with the use of standardized procedures to the research centres under the EMEP Steering Body. This helped to establish a robust database on emissions, which has been used to study, predict and model transboundary pollutant fluxes across the northern hemisphere. Such a development of provisions under the Convention, from those relatively mild and easily acceptable, set by the Convention itself, to the stricter ones, albeit suitably flexible and adjusted to the varying conditions in respective countries, provided for in subsequent proto-

cols, assured a proportionally great number of ratifications and implementations. This made the Convention approach highly effective, in particular concerning sulphur and nitrogen oxides, whose emissions declined significantly in the ECE region over the past 40 years.

The Convention today

At present, Parties to the Convention embrace 50 states (from among 56 ECE member states) and the European Union. The Executive Body is the governing body of the Convention receiving assistance from subsidiary bodies, including:

- Implementation Committee, which tackles the matters of the Parties compliance with the provisions provided for by the Convention and Protocols,
- Working Group on Strategies and Review (WGSR),
- Working Group on Effects (WGE),
- EMEP Steering Body.

The Working Group on Strategies and Review receives reports from two Task Forces: on Techno-Economic Issues and Reactive Nitrogen, while the Working Group on Effects supervises six International Cooperation Programmes (ICPs) together with their task forces and programme centres – whose responsibility includes the integrated monitoring of air pollution, its modelling and mapping as well as pollutant impacts on waters, forests, vegetation, plantations, materials and cultural heritage.

Here belongs also the working group shared with WHO, which tackles the human health aspects of air pollution as well as an expert group for dynamic modelling, which has developed into the Centre of Dynamic Modelling since January 1st 2020. Five different research Centres operate within EMEP, which are responsible for emission inventory, modelling and forecasting, in addition to four Task Forces providing fora for discussion and scientific exchange. The Executive Body is also in charge of the Coordination Group, whose task is to develop coordination and provide support for states of Eastern Europe, Caucasus and Central Asia (EECCA).

The last three of the abovementioned protocols are of special importance now, even if the Protocols on heavy metals and POPs have lost some momentum following the adoption and entry into force of the global agreements, including 2004 Stockholm Convention on persistent organic pollutants (UNEP, 2018) and 2017 Minamata Convention on mercury (UNEP, 2019). Whereas, the Gothenburg Protocol has a high status, since it regulates a wide spectrum of issues, from the permissible levels of annual emission of basic

pollutants such as sulphur and nitrogen oxides, non-methane volatile organic compounds and ammonia, to the emission standards for numerous stationery and mobile pollution sources along with the fuel quality requirements, to the best available techniques to keep down the ammonia emission from agriculture (UN ECE, 1999).

The Protocol was amended following a long negotiation process in 2012, to include new tighter reduction targets for sulphur and nitrogen oxides, ammonia and non-methane volatile organic compounds (NMVOC) to be achieved by 2020 and beyond, and the reduction targets for the new compound – particulate matter PM 2.5. New standards were set for the content of NMVOCs in products and new limit values for specific emission sources, both stationary and mobile. The amendments entered into force in 2019, while the European Union adopted them already in 2017 (the EU is Party to the Protocol). These reduction targets were earlier still, in 2016, the base for setting tighter requirements in the EU Directive 2016/2284 on the reduction of national emissions of certain atmospheric pollutants (EU, 2016). Thus, all the EU Member States have now the obligation to achieve the reduction targets, including those States, like Poland, which has not yet ratified the Gothenburg Protocol.

After a prolonged debate, it was agreed that the Convention should not be extended to include states outside the UN ECE. That notwithstanding, the scope of cooperation has been broadened to embrace other regions of the world and international organizations, in particular, WHO and WMO. Given the effective procedures and instruments designed under the Convention, it has become an exemplary precedent, which is now being followed by, e.g. Asian states.

Achievements

In the UN ECE region, the adoption of the Convention was crucial for initiating international cooperation, which was quite an issue at that time. This contributed to the development of air pollution abatement policies and thus, to a significant decrease in the emission of air pollutants, in particular of sulphur oxides. The scientific report established in 2016, at the request of the Executive Body, summarizing the Convention achievements to date (Maas, 2016), acknowledged that the total annual emission from the Convention Member States declined by more than 60% for SO_2 and by ca. 40% for NOx between the years 1990-2010. In the case of ammonia, particulate matter PM2.5 and NMVOC, there was also a decline, but much lower, whereby this decline was especially visible in the initial period of the Convention.

The Convention pioneered in regulating the emission of heavy metals and persistent organic pollutants. The report mentioned above acknowledged that the measures designed under the Convention significantly reduced acidification threats to forest and aquatic ecosystems and prevented 600,000 premature deaths annually in the UN ECE region. Nevertheless, air pollution is still considered the cause of many premature deaths.

Under the Convention, a unique approach was adopted to the air pollution issue, which was conceived as an 'effect-oriented' approach, developed to assess the air pollution effects considering its environmental consequences, based on critical loads and levels. The latter is understood as thresholds for pollutant loads, below which no harmful effects are expected to occur in the environment while taking simultaneously into account multiple pollutants and their possible impacts and inter-relationships (multi-pollutant multi-effect approach).

The efforts under the Convention were instrumental in the development of scientific knowledge and numerous databases. A vast amount of data has been collected under the EMEP programme, both imission data from monitoring and emission data from reporting, and the data quality has been systematically improving.

Technical and scientific reports have been published annually, while the knowledge database on pollutant monitoring, emission, effects and migration as well as on emission reduction techniques and costs has been continuously extended and updated. Likewise, integrated modelling and predicting potential have been advancing. The members of task forces contribute to developing manuals, guidelines and guidebooks, such as the 'EMEP/EEA air pollutant emission inventory guidebook' (EEA Report 13/2019), which has been constantly updated and applied for reporting under the NEC Directive as well, or the 'Framework Code for Good Agricultural Practice for Reducing Ammonia Emissions' (UN ECE, 2015), developed by the Task Force on Reactive Nitrogen as a base to prepare national codes of good practice.

Moreover, legislative arrangements, which have been developed under the Convention, allow for a flexible approach to the implementation of its provisions and a stepwise fulfilment of commitments. This is important when ratifying the Convention and has special significance for the states from the EECCA region. Both the way the Convention functions and the legislative solutions applied have been considered as exemplary for other agreements and regions of the world.

Future challenges

The abovementioned achievements, however, do not grant that the issue of excessive air pollution in the UN ECE region has been solved. Contrastingly, a distinct decelerating trend was observed for the decline of the monitored air pollutant values, and presently, one cannot reasonably expect such spectacular effects of the Convention, as it was in the nineties of the 20th century. Further reduction of emissions becomes more difficult and costly for the states of the UN ECE region, including the European Union, the more so that the sectors posing the greatest threat to the air quality include, among others, agriculture, food industries and household heating. Further reduction of emissions in these sectors requires not only increased investments and introduction of best available technologies but also changes of the consumers' lifestyles, diet and habits. The latter seems to be much more challenging to be regulated with legal provisions and standards.

The newest report concerning the emissions inventory within the European Union published by the European Environment Agency (EEA Report No 08/2019) states that more than half of the 26 pollutant emissions monitored within the UE have slightly grown up in 2017 as compared to the preceding year. Declining trends are still valid for the emissions of sulphur and nitrogen oxides, whereby the latter poses a serious problem due to disruptions of the global nitrogen cycle and detrimental effects in humans and the environment. On the other hand, the emissions of NMVOCs, certain POPs, heavy metals and ammonia have increased. The growing emission of ammonia is especially challenging for the EU, since in the years 1990-2017, the percent decrease for this emission was significantly lower than for other pollutants, while in 2014-2017 it increased by 2.5% (EEA, 2019).

The new Long-term strategy for the Convention on Long-range Transboundary Air Pollution adopted in 2018 (ECE/EB.AIR/142/Add.2) addresses the following most important future challenges:

- Reduction in the emission of particulate matter, including black carbon, and precursors of secondary particulate matter – given their significant health effect in terms of human morbidity and mortality as well as the detrimental impact on the environment (acidification, salinization) and materials (corrosion),
- Reduction in the emission of tropospheric ozone precursors, including methane – given the damaging effect of ozone on ecosystems, and on vegetation in particular, and considering the predicted renewed growth of the atmospheric ozone concentrations in the years 2020-2030,
- Solving the problem of nitrogen cycle disruption in the environment and the excessive emission of nitrogen compounds (especially of ammonia)

– given the growing eutrophication and disruption of global and regional nitrogen cycles.

Other significant priorities under the Strategy involve further study on the effects of air pollutants and their interactions with ecosystem functioning and climate change, in addition to the development of air quality monitoring, pollutant impact evaluation and modelling. The important tasks envisaged by the Strategy embrace studies on the effect of the hemispheric and regional pollution levels on the local air quality, especially in urban areas as well as studies on synergy and effectiveness of mitigation efforts undertaken at various scales.

The increase in ratification numbers is of vital importance, in particular as concerns the three last protocols (especially among the EECCA states, with which intensive talks are held, supported by advisory meetings and workshops) as well as the development, under the Convention, of broad cooperation with organisations, institutions and initiatives dealing with similar issues. To support these efforts, a new initiative was launched – the Forum for International Cooperation on Air Pollution. When it comes to further tightening of commitments provided for in the protocols to the Convention, the work has been already initiated to develop a successive update to the Gothenburg Protocol, which shall regulate emissions of black carbon and methane as well as the emission from marine shipping.

Concluding remarks

Despite the lapse of time, the LRTAP Convention remains the most important regional agreement on controlling and reducing the damage to human health and the environment caused by transboundary air pollution. The agreement has been evolving over the past four decades and has thus maintained the form, which fits in the present reality, even more, it has been considered as a landmark example to inspire regional solutions elsewhere. However, financial support for activities under the Convention remains a permanent problem, while there are still many challenges ahead.

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