Unit 1 – Transboundary Air Pollution

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1. Introduction

Sulphur dioxide ("SO_2") and nitrogen oxide ("NO_X") are the primary causes of acid rain. Although some quantities of SO_2 and NO_X are also produced by nature, human activities generate the majority of these gases and the resulting environmental problems. Emissions of SO_2 and NO_X originate from stationary sources, such as coal-fired and oil-fired power stations, and from mobile sources, such as cars and trucks, ships, and aircrafts.

Acid rain occurs when SO_2 and NO_X react in the atmosphere with water, oxygen, and other chemicals, forming various acidic compounds. Sunlight increases the rate of most of these reactions. The result is a mild solution of sulphuric acid and nitric acid that is deposited back onto land through wet dispositions like rain, fog or snow, as well as through dry disposition. The atmosphere's acidity is carried by wind, which blows these particles and gases onto buildings, plants and water.

Large quantities of acid rain have detrimental consequences for wildlife, forests, soils, freshwater, and buildings. Rain containing SO_2 and NO_X acidifies the soil and water, killing plants and animals. Surface water acidification can lead to a decline in fish population and other aquatic species. Acid rain also harms trees by weakening them through damage to their leaves. A survey of European forests conducted in the mid-1990s revealed that every fourth tree suffered from abnormal thinning of the crown, which was largely attributed to air pollution. Finally, acid rain can be detrimental to man-made structures, dissolving, for example, certain types of building stone.

Smog

Smog is a mixture of carbon monoxide, ground-level ozone, and particulate matter. Carbon monoxide is a poisonous gas emitted by vehicles and released by forest fires and open burning. Smog is formed from the reaction of sunlight, volatile organic compounds (VOCs) and NO_X. VOCs come from a variety of sources including industrial operations, vehicles and area sources (e.g., gas station refilling, open burning, paints and solvents in households, incomplete combustion in home heaters, etc.). Smog is a powerful irritant that can cause harm to humans even at levels where it is invisible to the eye. The inhalation of ozone and particulate matter can cause decreased lung capacity, exacerbate cardio-respiratory diseases and worsen asthma. Exposure to smog also decreases the body's defence mechanisms against infections.

It is well established that air pollutants such as SO2 and NO_X, which are often emitted through factory smokestacks, can travel hundreds or even thousands of kilometres. Consequently, the environmental impacts from air pollution may occur in areas far from their sources.

Smog has created local, regional, and international problems since the beginning of the industrial revolution.

Trail Smelter Arbitration

In the nineteenth century, fumes emitted by a smelter located in Trail, Canada, near the United States border, raised a problem of transboundary air pollution and led to claims of compensation for the harm caused. Some decades later, in 1941, the Trail Smelter Arbitration articulated the “no-harm obligation” for the first time: countries are obligated to avoid causing transboundary air pollution that leads to environmental damage in other nations.

The court held that “under the principles of international law...no state has the right to use or permit the use of its territory in such a manner as to cause injury by fumes in or to the territory of another or the properties or persons therein, when the case is of serious consequence and the injury is established by a clear and convincing evidence.”

International Efforts

International efforts to identify causes and effects of transboundary air pollution were not initiated until the late 1960s. During the 1970s, research conducted in Europe and North America led to the development of international legislation in this field.

The World Health Organization (WHO) estimates that in 2012 around 7 million premature deaths resulted from air pollution (one in eight of total global deaths), more than double previous estimates. According to WHO, outdoor air pollution caused 3.7 million premature deaths in 2012. Indoor air pollution is responsible for about 4.3 million premature deaths every year. While the problem of transboundary air pollution traditionally has been discussed largely in the context of the developed world, it is clear that air pollution is a serious and growing problem around the globe. In many developing countries, emissions are set to rise dramatically in the coming years if the countries follow conventional development paths to industrialization.

In this light, United Nations Environment Assembly of the United Nations Environment Programme (UNEA) at its first session in 2014 encouraged governments to take action across sectors to improve air quality to protect human health and the environment and to formulate action plans and establish and implement nationally determined ambient air quality standards, taking into account the World Health Organization Air Quality Guidelines and other relevant information and to establish emissions standards for their significant sources of air pollution.

2. The Geneva Convention on Long-Range transboundary Air Pollution

In the 1960s, scientists demonstrated the interrelationship between sulphur emissions in continental Europe and the acidification of Scandinavian lakes, confirming that air pollutants travel several thousands of kilometres and setting the basis of study of long-range transboundary air pollution.

In 1972, the United Nations Conference on the Human Environment signalled the start for active international cooperation to combat the problem of air pollution. In November 1979, a ministerial meeting was held in Geneva within the Framework of the United Nations Economic Commission for Europe (UNECE) on the Protection of the Environment. This meeting resulted in the signature of the Convention on Long-Range Transboundary Air Pollution by 34 governments and the European Community. The Convention entered into force in 1983 and currently has 51 Parties, including the United States and Canada.

The Convention created the framework for controlling and reducing the damage to human health and the environment caused by transboundary air pollution.

Definitions

The Convention defines air pollution as “the introduction by man directly or indirectly of substances or energy into the air, resulting in deleterious effects of such a nature as to endanger human health, harm living resources and ecosystems and material property, and impair or interfere with amenities and other legitimate uses of the environment …”

Long-range transboundary air pollution means air pollution whose physical origin is situated wholly or in part within the area under the national jurisdiction of one State and which has adverse effects in the area under the jurisdiction of another State at such a distance that it is not generally possible to distinguish the contribution of individual emission sources or groups of sources.

Objective

The Convention outlines the general principles of international cooperation for the abatement of air pollution and provides an institutional framework linking science and policy.

Its overall objective is to protect human health and the environment from air pollution. The Convention seeks to coordinate Parties' efforts by means of increased research, monitoring and information exchange on air pollution and its effects and developing emission reduction strategies.

Institutional Arrangements

The Convention designates a Secretariat and sets up an Executive Body.

As stipulated in article 11 of the Convention, the Executive Secretary of UNECE provides the secretariat for the Executive Body for the Convention. It does so within the UNECE Environment Division, based in Geneva.

The Executive Body consists of representatives of the Parties and meets annually to review the implementation of the Convention and its Protocols and assess the effectiveness of national policies. In doing so, the Executive Body relies on data on emissions of various pollutants covered by the Convention and its Protocols from different sources communicated by Parties themselves, as required by article 8 of the Convention and relevant articles under its Protocols.

To provide scientific support to the Convention, the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) has been established. The Organization for Economic Co-operation and Development (OECD) initiated EMEP as a special programme in 1977. Since then, the EMEP network has expanded to about 300 monitoring sites in over 40 UNECE countries. EMEP's main functions include the collection of emission data, measurement of air quality, modelling of atmospheric transport and deposition of air pollution, and integrated assessment modelling.

Compliance and Supervision

The Convention and the 1985 First Sulphur Protocol affirm the Executive Body's responsibility to review implementation and require parties to submit reports. However, none of the protocols contain any formal provision for review of compliance.

Thus, in 1997, the Executive Body established an Implementation Committee for the review of compliance by the Parties with their obligations under the protocols to the Convention. Executive Body Decision 2012/25 on "Improving the functioning of the Implementation Committee" contains in the annex the Committee's Terms of Reference "Implementation Committee, its structure and functions and procedures for review of compliance." It supersedes the Committee's previous Terms of References contained in Executive Body Decision 2006/2. .

The Implementation Committee has responsibility for reviewing compliance with all of Convention´s Protocols under a common procedure by considering any submission or referral of possible non-compliance by an individual Party with any of its emission reduction obligations under a given protocol, reviewing periodically compliance by Parties with their reporting obligations based on referrals by the secretariat and carrying out in-depth reviews of specified obligations in an individual protocol at the request of the Executive Body. The Executive Body may then decide on non-discriminatory measures to secure compliance upon recommendation by the Committee. However, its decisions require consensus and thus can be easily blocked.

Transboundary air pollution in Europe has fallen substantially, especially in relation to SO2 pollution. The emissions of SO2 have decreased by about 80% since 1990. Emissions of other major polluting substances like nitrogen oxides, volatile organic compounds and carbon monoxide fell in the range of 40% to 60% in the same period. Thus, the overall picture is one of compliance and improvement. The Convention and Protocols have contributed to solving the problem of acidification in the most part of Europe and to succeeding in reversing the negative trend of air pollution in Europe. However, challenges of air pollution and its transboundary aspects are still present in the region. For example, cities in Europe are facing challenges of fine particulate matter and ground-level ozone pollution, also due to transboundary transport of ammonia and ozone-precursors.

3. Protocols to the Convention

The Convention has provided the basis for the development of several protocols addressing transboundary air pollution. Within the framework of the Convention eight protocols have been adopted.

1985 First Sulphur Protocol

The 1985 (Helsinki) Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at Least 30 per cent (1985 First Sulphur Protocol) was adopted on 8 July 1985, and entered into force on 2 September 1987.

The 1985 First Sulphur Protocol requires its Parties to reduce emissions of their transboundary air pollution by 30% by 1993. Europe recorded substantial decreases in sulphur pollution, despite the fact that three important emitters (including the United States, United Kingdom, and Poland) did not initially ratify the Protocol.

The then twenty-one Parties to the 1985 First Sulphur Protocol reduced the 1980-level sulphur emission by more than 50% from 1987 to 1993. In 1989, the Executive Body began developing a revised protocol incorporating a more sophisticated approach to emission control.

1994 Second Sulphur Protocol

The 1994 (Oslo) Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Further Reduction of Sulphur Emissions (1994 Second Sulphur Protocol) was adopted on 14 June 1994 and entered into force on 5 August 1998. Although the 1994 Protocol superseded the 1985 Sulphur Protocol those that did not accede to it remain bound by the obligations of the latter.

The 1994 Second Sulphur Protocol acknowledges the need for precautionary measures to prevent transboundary air pollution from damaging environment and natural resources and is based on the "critical loads" approach. Critical loads are the maximum amount of pollutants that ecosystems can tolerate without being damaged. The Protocol's objective is to reduce sulphur depositions below the level where significant damage is likely to occur. The country-specific loads, which are based on a mapping of actual SO_2 depositions and sources, are specified in Annex I of the Protocol. Each Party must meet minimum emission targets within varying time scales. The overall SO_2 emission reduction for all parties is more than 50%.

Implementation of the 1994 Second Sulphur Protocol is mainly left to the discretion of Parties but they are required to use the "most effective measures" appropriate to the circumstances of each Party. These can include energy efficiency, use of renewable energy such as wind power, reducing the sulphur content of fuel, the application of best available technology and the use of economic instruments such as taxes of tradable permits. Parties are required to report their SO_2 emissions and their implementation measures (article 5). Sulphur emission ceilings, which only have information purposes, were amended in 2007 with an adjustment to Annex II to the Protocol.

1988 NOX Protocol

The 1988 Sofia Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes (the 1988 NO_X Protocol) was adopted on 1 November 1988, and entered into force on 14 February 1991.

The 1988 NO_X Protocol requires its Parties to stabilize their NO_X emissions on their transboundary air pollution at 1987-levels by 1994. The 1988 NO_X Protocol covers both major stationary sources such as power plants, and mobile sources such as vehicle emissions. A second step to the 1988 NO_X Protocol requires the application of an effects- based and critical loads approach.

1991 VOC Protocol

The 1991 (Geneva) Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes (the 1991 VOCs Protocol) was adopted on 18 November 1991, and entered into force on 29 September 1997. The 1991 VOCs Protocol specifies three options for emission reduction targets that have to be chosen upon signature or upon ratification:

(1) 30% reduction in emissions of volatile organic compounds by 1999, using a year between 1984 and 1990 as a basis (this option has been chosen by the majority of countries);

(2) The same reduction as for (1) within a Tropospheric Ozone Management Area ("TOMA") specified in Annex I to the 1991 VOCs Protocol and ensuring that by 1999 total national emissions do not exceed 1988 levels. Annex I specifies TOMAs in Norway; and,

(3) Finally, where emissions in 1988 did not exceed certain specified levels, Parties may opt for stabilization at that level of emission by 1999. This option has been chosen by for example Bulgaria, Greece and Hungary.

1998 POPs Protocol

The (Aarhus) Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Persistent Organic Pollutants (the 1998 POPs Protoco") was adopted by the Conventions's Executive Body on 24 June 1998, and entered into force on 23 October 2003.

In December 2009, the Parties adopted Amendments to the text and all annexes to the Protocol. The amendments to annexes V and VII entered into force for most of the Parties on 13 December 2010. In line with article 14, paragraph 3, the entry into force of the amendments to the text of the Protocol and to its annexes I, II, III, IV, VI and VIII requires ratification of two thirds of the Parties.

The 1998 POPs Protocol adds new substance focuses on a list of sixteen substances that have been singled out according to agreed risk criteria. The list includes eleven pesticides, two industrial chemicals and three by products/contaminants. The ultimate objective is to eliminate any discharges, emissions and losses of POPs. The 1998 POPs Protocol bans outright the production and use of some products (e.g., aldrin, chlordane, chlordecone, dieldrin, endrin, hexa- bromobiphenyl, mirex and toxaphene). Others are scheduled for elimination at a later stage (dichlorodiphenyltrichloroethane ("DDT"), heptachlor, hexaclorobenzene ("HCB"), polychlorinated biphenyls ("PCBs")). Finally, the Protocol severely restricts the use of DDT, gamma- hexachlorocyclohexane ("HCH" including lindane) and PCBs.

The 1998 POPs Protocol includes provisions for dealing with the wastes of products that will be banned. It also obliges parties to reduce their emissions of dioxins, furans, polycyclic aromatic hydrocarbons ("PAHs"), and HCBs below established base-year levels. Further, the 1998 POPs Protocol contains specific limits for the incineration of municipal, hazardous, and medical waste.

The 2009 amendments to the Protocols included seven new substances: hexachlorobutadiene, octabromodiphenyl ether, pentachlorobenzene, pentabromodiphenyl ether, perfluorooctane sulfonates, polychlorinated naphthalenes and short-chain chlorinated paraffins. Furthermore, the Parties revised obligations for DDT, heptachlor, hexachlorobenzene and PCBs as well as emission limit values (ELVs) from waste incineration. Parallel to this, with a view to facilitating the Protocol's ratification by countries with economies in transition, the Parties introduced flexibility for these countries regarding the time frames for the application of ELVs and best available technologies (BAT). Finally, the Parties adopted guidelines on BAT to control emissions of POPs in annex V. These amendments have not yet entered into force for the Parties that adopted them.

1998 Heavy Metals Protocol

The Executive Body adopted the (Aarhus) Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Heavy Metals (the 1998 Heavy Metals Protocol) on 24 June 1998 and it entered into force on 29 December 2003.

The 1998 Heavy Metals Protocol targets three harmful metals: cadmium, lead and mercury. Parties are required to reduce their emissions for these three metals below established base year levels. The 1998 Heavy Metals Protocol aims to cut emissions from industrial sources (iron and steel industry, non ferrous metal industry), combustion processes (power generation, road transport, and waste incineration. It establishes stringent limit values for emissions from stationary sources and suggests best available techniques for these sources, such as special filters or scrubbers for combustion sources or mercury-free processes.

The 1998 Heavy Metals Protocol also requires signatories to phase-out use of leaded petrol. It also introduces measures to lower heavy metal emissions from other products, such as mercury in batteries, and proposes the introduction of management measures for other mercury containing products (e.g., electrical components (thermostats, switches), measuring devices (thermometers, manometers and barometers), fluorescent lamps, dental amalgam, pesticides and paint).

The Protocol was amended in 2012, to adopt more stringent controls of heavy metals emissions and introduce flexibilities to facilitate accession of new Parties, notably countries in Eastern Europe, the Caucasus and Central Asia. The amendment to annex III entered into force on 9 January 2014. In line with article 13, paragraph 3, of the Protocol, the amendments to the text of the Protocol and its annexes other than III and VII require ratifications by two thirds of the Parties. These amendments have not yet entered into force.

1999 Ozone Protocol

The (Gothenburg) Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution to abate Acidification, Eutrophication and Ground- level Ozone (the Gothenburg Protocol) was adopted by Convention's Executive Body on 30 November 1999 and entered into force on 17 May, 2005.

The 1999 Gothenburg Protocol sets emission ceilings for 2010 in relation to four pollutants: SO2, NOX, VOCs, and ammonia. These ceilings were negotiated on the basis of scientific assessments of pollution effects and abatement options. Parties whose emissions have a more severe environmental or health impact and whose emissions are relatively cheap to reduce will have to make the biggest cuts. Once the 1999 Gothenburg Protocol is fully implemented, Europe's sulphur emissions should be cut by at least 63%, NOX emissions by 41%, VOC emissions by 40% and ammonia emissions by 17% compared to 1990. The 1999 Gothenburg Protocol also sets tight emission limit values for specific emission sources (e.g., combustion plant, electricity production, dry cleaning, cars and lorries, etc.) and requires best available techniques to keep emissions at the reduced levels.

Scientists estimate that once the 1999 Gothenburg Protocol is implemented, the area in Europe with excessive levels of acidification will shrink from ninety-three million hectares in 1990 to fifteen million hectares. In addition the area with excessive levels of eutrophication will fall from 165 million hectares in 1990 to 108 million hectares and the number of days with excessive ozone levels will be halved. Consequently, it is estimated that life-years lost as a result of the chronic effects of ozone exposure will be about 2,300,000 lower in 2010 than in 1990, and there will be approximately 47,500 fewer premature deaths resulting from ozone and particulate matter in the air. The exposure of vegetation to excessive ozone levels will be 44% lower than in 1990.

The Protocol was amended in 2012 to include national emission reduction commitments to be achieved in 2020 and beyond. Several of the Protocol's technical annexes were revised with updated sets of emission limit values for both key stationary sources and mobile sources.The revised Protocol is also the first binding agreement to include emission reduction commitments for fine particulate matter. Also for the first time, the Parties have broken new ground in international air pollution policy by specifically including the short-lived climate pollutant black carbon (or soot) as a component of particular matter. The revised Protocol also introduced flexibilities to facilitate accession of new Parties, mainly countries in Southern and Eastern Europe, the Caucasus and Central Asia. The amendments to annex I already entered into force on 5 June 2013. In line with article 13, paragraph 3, of the Protocol, the amendments to the text of the Protocol and its annexes II to IX and the addition of new annexes X and XI require ratifications by two thirds of the Parties.

1984 EMEP Protocol

Related to the financial aspects of the Convention, the Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Long- Term Financing of the Cooperative Programme for Monitoring and Evaluation of the LRTAP in Europe (EMEP) was adopted on 1984 and entered into force on 28 January, 1988.