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International Law on Transboundary Air Pollution

DAISY AGNES I.*

ABSTRACT

Transboundary air pollution has emerged as a significant environmental concern in the modern era owing to rapid industrialisation, technological advancement and increasing anthropogenic emissions. Unlike local air pollution, transboundary air pollution extends beyond the territorial boundaries of the State of origin, adversely affecting human health, ecosystems, biodiversity and property in other States. It therefore raises important questions concerning State responsibility, territorial sovereignty, international cooperation and liability for environmental damage. This paper examines the legal framework governing transboundary air pollution under international environmental law, with particular emphasis on the 1979 Convention on Long-range Transboundary Air Pollution, adopted under the auspices of the United Nations Economic Commission for Europe (UNECE), and its eight protocols. Finally, it examines the approach taken by international tribunals and courts in deciding disputes concerning harm caused by one State to another.

Keywords: *Transboundary Air Pollution, International Environmental Law, State Responsibility, UNECE, Long-range Transboundary Air Pollution, Environmental Liability*

I. INTRODUCTION

Advances in science and technology have led to the growth of industry and to new inventions, one negative consequence of which is pollution in its different forms. This has increased the risk of damage not only to the environment but also to life and property. Air pollution, moreover, is not confined to a particular territory: it can travel across national borders. Such extraterritorial effects have long been a concern of international law, as part of international environmental law and also of international energy law.

Clean air has become vital in the modern context because of increasing air pollution. In a densely populated country such as India, many people suffer from respiratory problems. Air pollution refers to harmful substances, such as gases and particles, that enter the earth's atmosphere and harm human health and ecosystems.[1]

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[1] *See* Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution to Abate Acidification, Eutrophication and Ground-Level Ozone pmbl., Nov. 30, 1999, 2319 U.N.T.S. 81 [hereinafter Gothenburg Protocol] (recording that "nitrogen oxides, sulphur, volatile organic compounds and reduced nitrogen compounds have been associated with adverse effects on human health and the environment").

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Respecting the territorial integrity of States, the United Nations Economic Commission for Europe (UNECE) has developed a convention and several protocols to address the problem of transboundary air pollution across its region.

Transboundary air pollution covers only pollution that results from human activity and causes loss or injury to persons or things in another State. It arises only between States: the State in which the pollution originates and the State affected by it.

Four criteria must be fulfilled for pollution to be considered transboundary air pollution:

1. The activity in question must be a human activity;
2. It must be within the territory or control of the State;
3. It must have given rise to harm or injury; and
4. That harm must be to persons or things within the territory or control of another State.[2]

Article 1(a) of the 1979 Convention on Long-range Transboundary Air Pollution defines the term: "'Air pollution' means 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, and 'air pollutants' shall be construed accordingly".[3]

The principles of international law also apply to transboundary pollution. The following principles are relevant to transboundary air pollution:[4]

1. *Sic utere tuo ut alienum non laedas*: Principle 2 of the Rio Declaration provides that States have the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States.
2. Environmental information: Principle 10 requires that each individual have appropriate access to information concerning the environment held by public authorities, and that States make such information widely available, as a key mechanism for ensuring that environmental rules are effectively applied.

[2] PADMA, INTERNATIONAL ENVIRONMENTAL LAW (Asia Law House 2003).
[3] Convention on Long-Range Transboundary Air Pollution art. 1(a), Nov. 13, 1979, 1302 U.N.T.S. 217 [hereinafter CLRTAP].
[4] Volker Röben, *Air Pollution, Transboundary Aspects*, *in* MAX PLANCK ENCYCLOPEDIA OF PUBLIC INTERNATIONAL LAW (2015), https://opil.ouplaw.com/display/10.1093/law:epil/9780199231690/law-9780199231690-e1560, https://doi.org/10.1093/law:epil/9780199231690/e1560.

3. Liability and compensation: Principle 13 requires States to develop national law regarding liability and compensation for the victims of pollution and other environmental damage, and to cooperate in developing further international law on the subject.
4. Precautionary principle: Principle 15 provides that, where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.
5. Environmental impact assessment: Principle 17 requires an environmental impact assessment, as a national instrument, for proposed activities that are likely to have a significant adverse impact on the environment, which includes an activity likely to cause transboundary pollution.
6. Prior information and consultation: under Principle 19, States shall provide prior and timely notification and relevant information to potentially affected States on activities that may have a significant adverse transboundary environmental effect, and shall consult with those States at an early stage and in good faith.[5]
7. The effectiveness of procedure: the Rio principles rely essentially on procedure to achieve the objective of sustainable development in regard to transboundary pollution.[6]

II. The Convention on Long-range Transboundary Air Pollution

The Convention on Long-range Transboundary Air Pollution is an international framework for reducing air pollution that follows the steps of the air quality management framework. In the 1960s, scientists discovered that air pollutants, often emitted thousands of kilometres away, were causing acid rain that threatened ecosystems in the Northern Hemisphere. This led to a public outcry and to the realisation that transboundary air pollution required international cooperation. The Convention was accordingly negotiated and signed in 1979, and it entered into force in 1983.[7]

[5] U.N. Conference on Environment and Development, *Rio Declaration on Environment and Development*, princs. 2, 10, 13, 15, 17, 19, U.N. Doc. A/CONF.151/26 (Vol. I), annex I (Aug. 12, 1992).
[6] Röben, *supra* note 4.
[7] U.N. Econ. Comm'n for Eur., *Convention on Long-range Transboundary Air Pollution* (UN CC:e-Learn course), https://unccelearn.org/course/view.php?id=150&sectionid=1739 [hereinafter UNECE Course]; *see also* CLRTAP, *supra* note 3 (concluded at Geneva on Nov. 13, 1979; in force Mar. 16, 1983).

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The Parties to the Convention are "[d]etermined to promote relations and co-operation in the field of environmental protection".[8] Articles 2 to 5 set out the Convention's fundamental principles. Its articles provide as follows:

Article 2 states the Parties' determination to protect man and his environment against air pollution, and to endeavour to limit and, as far as possible, gradually reduce and prevent air pollution, including long-range transboundary air pollution.

Article 3 requires the Parties to develop, by means of exchanges of information, consultation, research and monitoring, policies and strategies to combat the discharge of air pollutants.

Article 4 obliges the Parties to exchange information on, and review, their policies, scientific activities and technical measures.

Article 5 provides for consultations between Parties affected by long-range transboundary air pollution and Parties in which a significant contribution to such pollution originates.

Article 6, on air quality management, requires each Party to develop the best policies and strategies, including air quality management systems and control measures, in particular by using the best available technology which is economically feasible and low- and non-waste technology.

Article 7 deals with research and development: the Parties are to cooperate in research into, and the development of, technologies for reducing emissions, techniques for monitoring and measuring them, and improved models of the transmission of air pollutants.

Article 8 requires the Parties to exchange information on emissions, on the policies implemented by States and on control technologies.

Article 9 deals with the Co-operative Programme for the Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP).

Articles 10 and 11 establish the institutional arrangements for the Convention: the Executive Body and the secretariat.

Articles 12 to 18 set out the procedures for amendment, the settlement of disputes, signature, ratification, entry into force and withdrawal, and identify the authentic texts.[9]

A. The Convention in practice

First, establishing targets: once the Executive Body decides to act, in particular by introducing a new protocol or revising an existing one, scientific bodies review the existing data on

[8] CLRTAP, *supra* note 3, pmbl.
[9] *Id.* arts. 2–18.

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emissions and make suggestions, which are discussed within the Working Group on Strategies and Review and finally adopted by the Executive Body.[10]

Secondly, determining emission reductions: after assessing emission and air quality levels, the Parties determine, through negotiation, each State's individual level of reduction as its contribution to attaining the required target. The Executive Body then adopts the emission reduction commitments.

Thirdly, developing control strategies: certain protocols set emission limits based on best available techniques. States choose the control techniques that best suit their individual circumstances, and Task Forces under the Working Group on Strategies and Review develop policy guidance documents to assist them.

Fourthly, implementation: implementation begins once States ratify a protocol at the national level. To assist Parties with ratification and implementation, the secretariat provides capacity-building, awareness-raising, outreach and cooperation activities. Once Parties have ratified a protocol, they must comply with its obligations.

Fifthly, compliance: emission inventories are reviewed by the scientific bodies and then by the Implementation Committee for compliance checking.

Sixthly, the science-policy interface: the scientific bodies monitor emission levels and air quality, and evaluate whether the Parties are reaching the targets set.[11]

The Convention was drafted only after scientists had demonstrated the link between sulphur emissions in continental Europe and the acidification of Scandinavian lakes, and it had been confirmed that air pollutants could travel several thousand kilometres before deposition and damage occurred. Cooperation at the international level was therefore necessary to solve problems such as acidification.[12]

The Convention has been extended by eight protocols:

1. The 1984 Protocol on Long-term Financing of the Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP);
2. The 1985 Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent;

[10] UNECE Course, *supra* note 7; *see* CLRTAP, *supra* note 3, art. 10(2).
[11] UNECE Course, *supra* note 7.
[12] *Id.*

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3. The 1988 Protocol concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes;
4. The 1991 Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes;
5. The 1994 Protocol on Further Reduction of Sulphur Emissions;
6. The 1998 Protocol on Heavy Metals;
7. The 1998 Protocol on Persistent Organic Pollutants (POPs); and
8. The 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone.[13]

B. The 1984 Geneva Protocol on Long-term Financing of the Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe

The Executive Body adopted the Protocol on Long-term Financing of the Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) on 27 September 1984, and the Protocol was opened for signature at Geneva on 28 September 1984.[14]

The Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) was established in 1977 as a programme under the United Nations Economic Commission for Europe.

The Protocol requires mandatory contributions from the Contracting Parties within the geographical scope of EMEP, which are deposited in the General Trust Fund; the mandatory contributions are calculated in accordance with the Annex to the Protocol.[15] The Protocol was concluded to provide long-term financing for EMEP, which is provided for in Articles 9 and 10 of the Convention. As a first step, EMEP is based on the monitoring of sulphur dioxide and related substances, and the Convention aims to base the monitoring programme on the framework of both national and international programmes.[16]

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[13] U.N. SECRETARY-GENERAL, *Multilateral Treaties Deposited with the Secretary-General*, ch. XXVII, nos. 1.a–1.h, https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-1&chapter=27&clang=_en [hereinafter Multilateral Treaties].

[14] Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Long-Term Financing of the Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe (EMEP), Sept. 28, 1984, 1491 U.N.T.S. 167 [hereinafter EMEP Protocol]; U.N. ECON. COMM'N FOR EUR., https://unece.org/environmental-policy/environmental-monitoring-and-assessment/emep-protocol; *see* Multilateral Treaties, *supra* note 13, no. 1.a.

[15] EMEP Protocol, *supra* note 14, arts. 3–4 & annex.

[16] *Id.* pmbl.; CLRTAP, *supra* note 3, art. 9(a), (c).

C. The 1985 Helsinki Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent

The Executive Body adopted the Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent at Helsinki on 8 July 1985.[17]

Article 2 of the Protocol requires the Parties to reduce their national annual sulphur emissions or their transboundary fluxes by at least 30 per cent, using 1980 levels as the basis for calculation, as soon as possible and at the latest by 1993.[18]

As a result of the Protocol, substantial cuts in sulphur emissions have been recorded in Europe. Taken as a whole, the 21 Parties to the Protocol reduced their 1980 sulphur emissions by more than 50 per cent by 1993; each Party individually reached the 30 per cent target, and eleven Parties achieved reductions of at least 60 per cent.[19]

D. The 1988 Sofia Protocol concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes

The Protocol was adopted on 31 October 1988. It obliges the Parties, as a first step, to control or reduce their national annual emissions of nitrogen oxides or their transboundary fluxes so that, by 31 December 1994 at the latest, these do not exceed their levels for the calendar year 1987.[20] The Parties must also apply national emission standards to major new stationary sources and to substantially modified stationary sources, based on the best available technologies which are economically feasible; apply national emission standards to new mobile sources on the same basis; and introduce pollution control measures for major existing stationary sources.[21]

Article 4 of the Protocol requires the Parties to make unleaded fuel sufficiently available. Under Article 6, the Parties are to identify and quantify the effects of emissions of nitrogen oxides on humans, plant and animal life, determine the geographical distribution of sensitive areas, and develop measurements and models to quantify the long-range transport of nitrogen oxides.[22]

The Technical Annex to the Protocol deals with two main matters:

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[17] 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, July 8, 1985, 1480 U.N.T.S. 215 [hereinafter Helsinki Protocol]; U.N. ECON. COMM'N FOR EUR., https://unece.org/environmental-policy/air/1985-helsinki-protocol-reduction-sulphur-emissions-or-their-transboundary.

[18] Helsinki Protocol, *supra* note 17, art. 2.

[19] *Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent*, InforMEA, https://www.informea.org/en/treaties/sulphuremissions.

[20] Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution Concerning the Control of Emissions of Nitrogen Oxides or Their Transboundary Fluxes art. 2(1), Oct. 31, 1988, 1593 U.N.T.S. 287 [hereinafter Sofia Protocol].

[21] *Id.* art. 2(2).

[22] *Id.* arts. 4, 6.

1. Control technologies for NOx emissions from stationary sources; and
2. Control technologies for NOx emissions from mobile sources.[23]

i. Control technologies for NOx emissions from stationary sources

Fossil fuel combustion is the main source of NOx emissions from stationary sources.[24]

The options for reducing NOx emissions are:

1. Energy management measures: energy saving and energy mix; and
2. Technical options: fuel switching or cleaning, other combustion technologies, process and combustion modifications, and flue gas treatment.[25]

ii. Control technologies for NOx emissions from mobile sources

Controlling emissions from road vehicles: in response to regulatory programmes for NOx emission reduction, advanced closed-loop three-way catalyst systems are being developed, with a focus on engine management and control of the air-fuel ratio.

Controlling emissions from in-use vehicles: durable emission-control systems, together with inspection and maintenance, are to be promoted.[26]

iii. General aspects of control technology for NOx emissions from on-road vehicles

A variety of technologies and design options are available that make the simultaneous control of different pollutants possible. In particular, after-treatment techniques for diesel engines have played a vital role in reducing emissions of nitrogen oxides. For some applications, reverse effects have been experienced when reducing NOx emissions (for example, in non-catalyst petrol or diesel engines). This may change with the use of new technologies, such as after-treatment cleaning devices and electronics.[27]

E. The 1991 Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes

The Executive Body adopted the Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes at Geneva on 18 November 1991. It targets the reduction of volatile organic compounds (VOCs), major air pollutants responsible for the formation of ground-level ozone.

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[23] *Id.* tech. annex.
[24] *Id.* tech. annex ¶ 3.
[25] U.N. ECON. COMM'N FOR EUR., https://unece.org/environment-policy/air/protocol-concerning-control-emissions-nitrogen-oxides [hereinafter UNECE, NOx Protocol]; *cf.* Sofia Protocol, *supra* note 20, tech. annex ¶ 5 (combustion and process modifications and flue gas treatment).
[26] UNECE, NOx Protocol, *supra* note 25; *cf.* Sofia Protocol, *supra* note 20, tech. annex ¶ 20 & tbl. 3.
[27] UNECE, NOx Protocol, *supra* note 25.

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The Protocol defines VOCs as follows: "'Volatile organic compounds', or 'VOCs', means, unless otherwise specified, all organic compounds of anthropogenic nature, other than methane, that are capable of producing photochemical oxidants by reactions with nitrogen oxides in the presence of sunlight".[28]

Article 2 obliges the Parties to control and reduce their emissions of VOCs in order to reduce their transboundary fluxes and the fluxes of the resulting secondary photochemical oxidant products, so as to protect human health and the environment from adverse effects.[29] The Protocol encourages the exchange of technology among the Parties through the promotion of the commercial exchange of available technology, direct industrial contacts and cooperation, the exchange of information and experience, and the provision of technical assistance.[30] It lists the major sources of anthropogenic non-methane VOC emissions from stationary sources, which are:

1. Use of solvents;
2. Petroleum industry, including petroleum-product handling;
3. Organic chemical industry;
4. Small-scale combustion sources;
5. Food industry;
6. Iron and steel industry;
7. Handling and treatment of wastes; and
8. Agriculture.[31]

F. The 1994 Oslo Protocol on Further Reduction of Sulphur Emissions

The Protocol on Further Reduction of Sulphur Emissions was concluded at Oslo on 14 June 1994. It builds on the 1985 Helsinki Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent, acknowledging the measures already taken by many countries to reduce sulphur emissions.[32]

[28] Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution Concerning the Control of Emissions of Volatile Organic Compounds or Their Transboundary Fluxes art. 1(9), Nov. 18, 1991, 2001 U.N.T.S. 187 [hereinafter VOC Protocol].
[29] *Id.* art. 2(1).
[30] *Id.* art. 4(1).
[31] *Id.* annex II ¶ 6.
[32] Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Further Reduction of Sulphur Emissions pmbl., June 14, 1994, 2030 U.N.T.S. 122 [hereinafter Oslo Protocol]; U.N. ECON. COMM'N FOR EUR., https://unece.org/environment-policy/air/protocol-further-reduction-sulphur-emissions.

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The Protocol obliges the Parties to control and reduce their sulphur emissions in order to protect human health and the environment from adverse effects, in particular acidifying effects, and to ensure, as far as possible, that depositions of oxidised sulphur compounds in the long term do not exceed the critical loads for sulphur given in Annex I.[33]

To implement their obligations under Article 2, the Parties are required to adopt national strategies, policies and programmes, and to take and apply national measures to control and reduce their sulphur emissions. They must also collect and maintain information on the actual levels of sulphur emissions and of the ambient concentrations and depositions of oxidised sulphur and other acidifying compounds, taking into account the work plan of EMEP.[34]

Annex II sets out the sulphur emission ceilings and percentage emission reductions. A Party that cannot comply in a given year because of exceptional circumstances may average its emissions over three years, but it must report to the Implementation Committee the reasons for exceeding the ceiling and the method by which the three-year average figure will be achieved.[35] Annex IV deals with control technologies for sulphur emissions from stationary sources. It identifies the major stationary source categories of sulphur emissions as follows:

1. Public power, cogeneration and district heating plants: (a) boilers; (b) stationary combustion turbines and internal combustion engines;
2. Commercial, institutional and residential combustion plants: (a) commercial boilers; (b) domestic heaters;
3. Industrial combustion plants and processes with combustion: (a) boilers and process heaters; (b) processes, e.g. metallurgical operations such as roasting and sintering, coke oven plants, processing of titanium dioxide (TiO2), etc.; (c) pulp production;
4. Non-combustion processes, e.g. sulphuric acid production, specific organic synthesis processes, treatment of metallic surfaces;
5. Extraction, processing and distribution of fossil fuels; and
6. Waste treatment and disposal, e.g. thermal treatment of municipal and industrial waste.[36]

Annex IV also outlines the general options for reducing sulphur emissions from combustion:

1. Energy management measures: energy saving and energy mix; and

[33] Oslo Protocol, *supra* note 32, art. 2(1).
[34] *Id.* art. 4.
[35] *Id.* annex II n.a.
[36] *Id.* annex IV ¶ 7.

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2. Technological options: fuel switching, fuel cleaning, advanced combustion technologies, process and combustion modifications, and flue gas desulphurization processes.[37]

G. The 1998 Aarhus Protocol on Heavy Metals

The Protocol on Heavy Metals targets cadmium, lead and mercury. It was concluded at Aarhus in 1998, entered into force in 2003 and was amended in 2012.[38] It aims to control emissions of these metals from anthropogenic activities that are carried over long distances in the air and harm health and the environment. These metals can enter the food chain, bioaccumulate in animals and the human body, and cause serious effects such as cancer, kidney and bone damage, and developmental disorders.[39]

Article 2 of the Protocol provides: "The objective of the present Protocol is to control emissions of heavy metals caused by anthropogenic activities that are subject to long-range transboundary atmospheric transport and are likely to have significant adverse effects on human health or the environment, in accordance with the provisions of the following articles."[40]

The Protocol offers guidance on identifying the best available techniques (BAT) to reduce heavy metal emissions from key industrial activities such as coal combustion, waste incineration, cement and glass production, chlor-alkali plants (for mercury) and metal production. It lays down stringent limit values for emissions from stationary sources and requires BAT for those sources, such as special filters or scrubbers for combustion sources, or mercury-free processes.[41]

The Protocol sets out the criteria for determining BAT as follows:[42]

(a) The use of low-waste technology;

(b) The use of less hazardous substances;

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[37] *Id.* annex IV ¶ 9.

[38] Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Heavy Metals annex I, June 24, 1998, 2237 U.N.T.S. 4 [hereinafter Heavy Metals Protocol] (entered into force Dec. 29, 2003); Exec. Body for the Convention on Long-Range Transboundary Air Pollution, Decisions 2012/5 and 2012/6 (Dec. 13, 2012); *see* Multilateral Treaties, *supra* note 13, nos. 1.f, 1.l.

[39] UNECE Course, *supra* note 7, https://unccelearn.org/course/view.php?id=150&sectionid=1741.

[40] Heavy Metals Protocol, *supra* note 38, art. 2; *see also* U.N. ECON. COMM'N FOR EUR., U.N. Doc. ECE/EB.AIR/115, https://unece.org/sites/default/files/2021-10/ECE.EB_.AIR_.115_ENG.pdf (text as amended in 2012).

[41] Heavy Metals Protocol, *supra* note 38, art. 3(2) & annexes III, V; UNECE Course, *supra* note 7, https://unccelearn.org/course/view.php?id=150&sectionid=1741.

[42] Heavy Metals Protocol, *supra* note 38, annex III ¶ 3, *as amended by* Exec. Body Decision 2012/6 (Dec. 13, 2012).

(c) The furthering of recovery and recycling of substances generated and used in the process and of waste, where appropriate;

(d) Comparable processes, facilities or methods of operation which have been tried with success on an industrial scale;

(e) Technological advances and changes in scientific knowledge and understanding;

(f) The nature, effects and volume of the emissions concerned;

(g) The commissioning dates for new or existing installations;

(h) The length of time needed to introduce the best available technique;

(i) The consumption and nature of raw materials (including water) used in the process and energy efficiency;

(j) The need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risks to it;

(k) The need to prevent accidents and to minimize their consequences for the environment;

(l) Information published by national and international organizations.

The concept of BAT is not aimed at the prescription of any specific technique or technology, but at taking into account the technical characteristics of the installation concerned, its geographical location and the local environmental conditions.

H. The 1998 Aarhus Protocol on Persistent Organic Pollutants

The Protocol on Persistent Organic Pollutants (POPs) was concluded at Aarhus, Denmark, on 24 June 1998.[43]

Under the Protocol, "'Persistent organic pollutants' (POPs) are organic substances that: (i) possess toxic characteristics; (ii) are persistent; (iii) bioaccumulate; (iv) are prone to long-range transboundary atmospheric transport and deposition; and (v) are likely to cause significant adverse human health or environmental effects near to and distant from their sources".[44]

Under Article 2, the objective of the Protocol is to control, reduce or eliminate discharges, emissions and losses of POPs. To achieve this objective, the Protocol stipulates three main obligations:

1. To eliminate the production and use of the substances listed in Annex I;

[43] Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Persistent Organic Pollutants, June 24, 1998, 2230 U.N.T.S. 79 [hereinafter POPs Protocol]; *see* Multilateral Treaties, *supra* note 13, no. 1.g.
[44] POPs Protocol, *supra* note 43, art. 1(7); *see also* U.N. ECON. COMM'N FOR EUR., U.N. Doc. ECE/EB.AIR/104, https://unece.org/sites/default/files/2021-10/ece.eb_.air_.104.e.pdf (text as amended in 2009).

2. To restrict the substances listed in Annex II to the uses described; and
3. To reduce total annual emissions of the substances listed in Annex III from the level of emission in a reference year.[45]

Parties must eliminate the production and use of the substances listed in Annex I, now twenty in number, subject to limited exceptions (for example, the use of lindane as a topical insecticide for public health purposes, and the recycling of certain articles). The destruction and disposal of Annex I substances must be environmentally sound and, preferably, domestic, taking into account international regimes such as the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.[46]

Annex II restricts perfluorooctane sulfonate (PFOS) and short-chain chlorinated paraffins to specific uses, which the Parties should take action to eliminate once suitable alternatives are available.

Annex III requires the Parties to reduce their emissions of four substances below the level of a reference year: polycyclic aromatic hydrocarbons (PAHs), dioxins and furans, hexachlorobenzene and, since the 2009 amendments, polychlorinated biphenyls (PCBs).[47]

The most important POPs emitted from stationary sources are:

1. Polychlorinated dibenzo-p-dioxins/furans (PCDD/F);
2. Hexachlorobenzene (HCB); and
3. Polycyclic aromatic hydrocarbons (PAHs).[48]

I. The 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone

The main objective of the Protocol, as amended in 2012, is to control and reduce emissions of sulphur, nitrogen oxides, ammonia, volatile organic compounds and particulate matter that are likely to cause adverse effects on human health and the environment.[49] The key requirement of the Protocol is that each Party meet its national emission obligations: the original text set national emission ceilings for 2010 in Annex II, and the 2012 amendments added emission

[45] POPs Protocol, *supra* note 43, arts. 2, 3(1)(a), 3(1)(c), 3(5)(a).
[46] *Id.* art. 3(1)(a)–(b) & annex I, *as amended by* Exec. Body Decisions 2009/1 and 2009/2 (Dec. 18, 2009); UNECE Course, *supra* note 7, https://unccelearn.org/course/view.php?id=150&sectionid=1742.
[47] POPs Protocol, *supra* note 43, annexes II–III, *as amended by* Exec. Body Decisions 2009/1 and 2009/2 (Dec. 18, 2009).
[48] POPs Protocol, *supra* note 43, annex V ¶ 6.
[49] Gothenburg Protocol, *supra* note 1, art. 2, *as amended by* Exec. Body Decision 2012/2 (May 4, 2012), Depositary Notification C.N.155.2013.TREATIES-XXVII-1-h (Feb. 28, 2013) (in force Oct. 7, 2019).

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reduction commitments for 2020 and beyond, expressed as percentage reductions from 2005 emission levels. The Parties must achieve and maintain these reductions.[50]

The amended preamble records that the Parties are "[c]oncerned also that emitted nitrogen oxides, sulphur, volatile organic compounds, ammonia and directly emitted particulate matter, as well as secondarily formed pollutants such as ozone, particulate matter and the reaction products of ammonia, are transported in the atmosphere over long distances and may have adverse transboundary effects".[51]

Emission sources include, for example, combustion plants, electricity production, dry cleaning, and cars and lorries. The Protocol sets limit values for such sources and calls on the Parties to apply best available techniques to keep emissions down.[52]

The emission limits are fixed country by country. Under Annex I, for Parties within the geographical scope of EMEP, the critical loads of acidity for ecosystems are determined in accordance with the Convention's Manual on Methodologies and Criteria for Modelling and Mapping Critical Loads and Levels and Air Pollution Effects, Risks and Trends. The critical level of particulate matter for human health is determined in accordance with the WHO air quality guidelines, as the mass concentration of PM2.5, and the critical levels of ammonia are determined, to protect plants, in accordance with the same Manual.[53] The Protocol, as amended in 2012, also lays down each Party's emission reduction commitments for these pollutants for 2020 and beyond, and limit values for emissions from stationary sources.[54]

Annex VIII prescribes limit values for fuels and new mobile sources, and Annex IX sets out measures for the control of emissions of ammonia from agricultural sources.[55]

J. Fixation of liability for causing transboundary air pollution

Trail Smelter (*United States v. Canada*) is widely regarded as the first case in which international liability for causing damage to the environment of another State was recognised. The tribunal held that "under the principles of international law, as well as of the law of the United States, 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,

[50] Gothenburg Protocol, *supra* note 1, art. 3(1) & annex II; Decision 2012/2, *supra* note 49.
[51] Gothenburg Protocol, *supra* note 1, pmbl., *as amended by* Decision 2012/2, *supra* note 49.
[52] Gothenburg Protocol, *supra* note 1, art. 3(2), (5)–(6) & annexes IV–VI, VIII.
[53] Gothenburg Protocol, *supra* note 1, annex I, *as amended by* Exec. Body Decision 2012/1 (May 4, 2012), Depositary Notification C.N.171.2013.TREATIES-XXVII.1.h (Mar. 7, 2013).
[54] Gothenburg Protocol, *supra* note 1, annexes II, IV–VI, *as amended by* Decision 2012/2, *supra* note 49.
[55] Gothenburg Protocol, *supra* note 1, annexes VIII–IX.

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when the case is of serious consequence and the injury is established by clear and convincing evidence".[56]

The Trail Smelter, operated by a company in British Columbia, Canada, emitted fumes that caused damage in the State of Washington. The dispute was referred to an arbitral tribunal under a convention signed by the two States at Ottawa on 15 April 1935, and the tribunal held that "the Dominion of Canada is responsible in international law for the conduct of the Trail Smelter".[57] It fixed an indemnity of US$78,000 for the damage caused in the State of Washington between 1 January 1932 and 1 October 1937, which Canada paid to the United States.[58]

In the *Corfu Channel* case, the International Court of Justice relied on "every State's obligation not to allow knowingly its territory to be used for acts contrary to the rights of other States".[59] Although the case concerned mines laid in Albanian waters rather than pollution, the principle applies equally to air pollution: a State that knows that activities within its territory are causing serious harm to another State must not allow them to continue unchecked.

The Court developed this reasoning in *Pulp Mills on the River Uruguay*. It held that the principle of prevention, as a customary rule, has its origins in the due diligence required of a State in its territory, so that "[a] State is thus obliged to use all the means at its disposal in order to avoid activities which take place in its territory, or in any area under its jurisdiction, causing significant damage to the environment of another State".[60] The Court also held that it "may now be considered a requirement under general international law to undertake an environmental impact assessment where there is a risk that the proposed industrial activity may have a significant adverse impact in a transboundary context".[61] The International Law Commission's 2001 Articles on Prevention of Transboundary Harm from Hazardous Activities similarly require the State of origin to "take all appropriate measures to prevent significant transboundary harm or at any event to minimize the risk thereof".[62]

III. CONCLUSION

The obligation of prevention recognised in *Corfu Channel* and *Pulp Mills*, and stated in Article 3 of the International Law Commission's 2001 Articles, requires States to take all appropriate

[56] *Trail Smelter* (U.S. v. Can.), 3 R.I.A.A. 1905, 1965 (Trail Smelter Arb. Trib. 1941).
[57] *Trail Smelter*, 3 R.I.A.A. at 1905, 1965–66.
[58] *Id.* at 1931, 1949.
[59] *Corfu Channel* (U.K. v. Alb.), Judgment, 1949 I.C.J. 4, 22 (Apr. 9).
[60] *Pulp Mills on the River Uruguay* (Arg. v. Uru.), Judgment, 2010 I.C.J. 14, ¶ 101 (Apr. 20).
[61] *Id.* ¶ 204.
[62] INT'L LAW COMM'N, *Draft Articles on Prevention of Transboundary Harm from Hazardous Activities*, art. 3, U.N. Doc. A/56/10 (2001).

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measures to prevent significant harm beyond their jurisdiction or, at any event, to minimize the risk of such harm. Once a State is aware that an activity within its jurisdiction threatens or causes damage to persons or property in another State, it must take measures to prevent that damage.

It is usually developing countries that fall prey to the harmful activities of wealthier States and become the victims of modern industrial activity. The main reasons are a lack of technological knowledge and the financial constraints they face in monitoring or controlling transboundary air pollution. Despite the measures taken at the international level, mainly in the form of conventions and protocols, further steps are needed for the effective reduction of transboundary air pollution. An international expert group of well-qualified scientists and technicians could be constituted to use advanced technology to detect the forms of air pollution that have severe consequences for the health of humans and animals and for the environment. The standards set in the protocols need to be revisited by the competent bodies from time to time, and a review of the steps taken by member States to implement them will help to achieve the goals of the Convention.

This paper further proposes that States be held liable for harmful activities without exception, by applying the principle of strict liability. The International Law Commission's 2006 Draft Principles on the Allocation of Loss point in this direction, although they place liability primarily on the operator rather than on the State: each State should ensure that prompt and adequate compensation is available for victims of transboundary damage, and the liability imposed "should not require proof of fault".[63] If appropriate steps are not taken by States with regard to transboundary air pollution, future generations will bear the cost of today's inaction.

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[63] INT'L LAW COMM'N, *Draft Principles on the Allocation of Loss in the Case of Transboundary Harm Arising out of Hazardous Activities*, princ. 4(1)–(2), U.N. Doc. A/61/10 (2006).

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