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Air, atmosphere and climate change

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This chapter will briefly analyse customary rules as they apply to atmospheric pollution and will then continue with a more detailed examination of treaty regimes in three selected areas: long-range transboundary air pollution; protection of the ozone layer; and climate change. The chapter will examine these frameworks in terms of the substantive issues they address, as well as the lessons to be learned from each. These three regimes are arguably the most important and provide lessons for both the future regulation of air and atmospheric pollution, and international environmental law as a whole.

Introduction

The regulation of atmospheric pollution is one of the earliest and best-developed areas of international cooperation and regulation in the field of the environment. Atmospheric pollutants, by their very nature, easily cross national boundaries and may cause harmful environmental effects and, as a result, conflicts between states, creating the need for international agreements on how emissions are handled. In addition, some emissions are only problematic upon reaching harmful concentrations in the atmosphere, as in the cases of ozone depletion and climate change, introducing the further complication of allocating how and where reductions should be made and who should pay for them. Tackling these environmental and political crises is a critical challenge for the international community. The nature and evolution of global efforts to address atmospheric pollution are the focus of this chapter. As in other sub-fields of international environmental law, most rules regulating atmospheric pollution are found in treaties. Obviously, international customary rules apply, *mutatis mutandis*, to atmospheric pollution as well. An increasingly important role is also played by soft law.

This chapter will briefly analyse customary rules as they apply to atmospheric pollution and will then continue with a more detailed examination of treaty regimes in three selected areas: long-range transboundary air pollution (LRTAP); protection of the ozone layer; and climate change. The chapter will examine these frameworks in terms of the substantive issues they address, as well as the lessons to be learned from each. These three regimes are arguably the most important and provide lessons for both the future of regulation of atmospheric pollution, and international environmental law as a whole.

Customary law and litigation

One could argue that international environmental law, at least in its modern sense, originated partly from the need to protect the joint atmosphere.[1] One of the earliest cases between states related to transboundary air pollution: the 1941 *Trail Smelter* arbitration award between Canada and the United States (US).[2] The arbitral tribunal's decision laid down what many now consider a fundamental principle of international environmental law: the obligation to prevent transboundary environmental harm.[3] The finding was the precursor of what is now known as Principle 21/2, which holds that states have sovereignty over their natural resources and the responsibility not to cause transboundary environmental harm.[4]

The dispute arose around a Canadian lead and zinc smelting complex in British Columbia that was emitting significant amounts of sulphur dioxide fumes. The US complained that the sulphur dioxide was carried on the winds into Washington State, damaging farmland and forests. Dissatisfied with the recommendations of a joint commission that the two countries had asked to review the issue,[5] the US pushed for the negotiation of a convention under which Canada would pay $350,000 for the damage caused through 1931, and agree to submit the matter to international arbitration. The convention was signed in 1935.[6]

1 Of course, given the inextricable ties between human civilisations and the natural resources on which we depend, rules governing the use of the environment date back centuries to earliest recorded history. While unilateral and bilateral agreements on the preservation of fauna and flora have existed since the mid-1800s, our focus here is on instruments that have been negotiated by the international community as a whole. For a history of environmental regulation, see E.C. Halliday, *An Historical Review of Atmospheric Pollution*, New York: World Health Organization/Columbia University Press, 1961; P. Hawken, *How the Largest Movement in the World Came Into Being and Why No One Saw It Coming*, New York: Viking, 2007.

2 *United States v Canada*, Ad Hoc International Arbitral Tribunal, *1941 UN Reports of International Arbitral Awards 1911*, 1938, p. 1941.

3 Scholars disagree about the importance of this case; see generally R.M. Bratspies and R.A. Miller (eds) *Transboundary Harm in International Law: Lessons from the* Trail Smelter *Arbitration*, Cambridge: Cambridge University Press, 2006.

4 The term 'Principle 21/2' refers to Principle 21 of the *Stockholm Declaration of the United Nations Conference on the Human Environment* (1972), Section I of the *Report of the United Nations Conference on the Human Environment* (1972), UN Doc A/Conf.48/14 and Corr 1, 11 ILM 1416 ('1972 Stockholm Declaration'); and Principle 2 of the *Rio Declaration on Environment and Development* (1992), Annex I, UN Doc A/Conf.151/26 (Vol. I) ('Rio Declaration').

5 Prevailing law at the time held that claims for damage had to be filed in the jurisdiction where the damaged land lay; however, Washington State had no jurisdiction over the Canadian smelter. The matter was initially, therefore, submitted to the International Joint Commission, a commission the two countries had established under a 1909 Boundary Waters treaty. The Commission investigated the situation and, in 1931, issued a report concluding that the smelter had, indeed, caused damage in Washington. The Commission had arrived at an estimate of $350,000 in damage and made several recommendations for reducing emissions going forward. *Trail Smelter Case (United States v Canada)* 3 RIAA 1905, 1911, Trail Smelter Arb. Trib., 1941.

6 *Convention for the Final Settlement of the Difficulties Arising through Complaints of Damage Done in the State of Washington by Fumes Discharged from the Smelter of the Consolidated Mining and Smelting Company* (1935), 162 LNTS 74 ('Trail Smelter Decision').

The arbitral tribunal was charged with devising a solution that was just to both parties, recognising states' interests in both economic activity and environmental integrity.[7] Finding that further damage had been caused to land and improvements in the US since 1932, it awarded damages of $78,000 (US) with interest until paid.[8] Most critically, it also found an:

> adequate basis [to conclude] 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 clear and convincing evidence.[9]

Looking forward then, the tribunal reasoned that further damage might occur in the future if some controls were not placed on the operation of the smelter and, in a ground-breaking move, invoked the obligation to prevent transboundary harm to justify laying down a regulatory regime, including maximum permissible sulphur emissions for the smelter.[10] The purpose was not to shut the smelter down but, rather, to devise restrictions under which it could continue to operate without causing damage in the US. This was a crucial development, signalling that states' duties with respect to serious transboundary harm extend beyond reparations for damage to include an obligation to prevent harm.

A second key principle of international environmental law to have achieved customary law status is the duty to cooperate.[11] Derived from the UN Charter's principle of good-neighbourliness, this duty encompasses, *inter alia*, obligations to share information with, notify and consult with other states in good faith and is asserted in almost every agreement in the field of modern international environmental law.[12] That it has achieved customary law status is hardly in dispute: as the International Tribunal for the Law of the Sea has observed, '[t]he duty to co-operate is a fundamental principle in . . . general international law.'[13]

The Trail Smelter case is probably the most significant dispute that has been decided by an international tribunal. Several other disputes have had the potential to further develop customary obligations in this field but, for varying reasons, did not result in decisions of

7 Trail Smelter Decision, p. 9:

> In all the consideration which the Tribunal has given to the problem presented to it, and in all the conclusions which it has reached, it had been guided by that primary purpose of the Convention expressed in the words of Article IV, that the Tribunal 'shall give consideration to the desire of the high contracting parties to reach a solution just to all parties concerned'.

8 Trail Smelter Decision, p. 37.
9 Trail Smelter Decision, p. 62.
10 Trail Smelter Decision, pp. 31–4
11 Prominent formulations of this principle can be found in Principle 24 of the 1972 Stockholm Declaration; and Principle 27 of the Rio Declaration.
12 For a detailed discussion of the meaning and origins of this principle, see P. Sands, *Principles of International Environmental Law*, Cambridge: Cambridge, 2003, pp. 249–51.
13 International Tribunal for the Law of the Sea, *The Mox Plant Case, Republic of Ireland v United Kingdom of Great Britain and Northern Ireland*, Case No. 10 – Request for Provisional Measures, December 3, 2001, para. 82.

such historic weight. Primary examples can be found in the International Court of Justice's jurisprudence on the issue of nuclear testing.

By 1973, all major states with nuclear weapons had signed up to the 1963 *Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water*,[14] except France.[15] France had conducted a series of atmospheric nuclear weapons tests in French Polynesia from 1966 to 1972, and was planning to commence another round in the spring of 1973. In response, Australia and New Zealand filed suit with the International Court of Justice (ICJ), challenging the legality of the tests under international law and asking the Court to order France to cease its testing.[16] As the basis for its claim, Australia asserted several violations of its rights, specifically the right of Australia and its people to be free from atmospheric nuclear weapon tests; the right to sovereignty over its territory and to determine what acts shall take place therein and, in particular, whether Australia and its people shall be exposed to artificial radiation; and, finally, the freedom of the high seas.[17] New Zealand's application was similar but instead of grounding its cause on its own individual rights, it sought to assert rights of 'all members of the international community' to be free from radioactive fallout from nuclear tests and contamination of the air, land and sea.[18]

France chose not to appear in the case, but later issued several unilateral declarations that it would end its testing programme.[19] In response, the Court felt that the desired objectives of Australia and New Zealand's suits had been accomplished and did not proceed with them.[20] When France announced in 1995 that it intended to resume nuclear weapons tests in the South Pacific, New Zealand tried to have the case reopened.[21] The Court declined on the grounds that the original case concerned atmospheric tests, whereas the new tests announced by France were to be underground,[22] so the legality of nuclear testing under international law remains unsettled.

Uncertainly prevails in the related area of liability for nuclear damage, as well. In the aftermath of the Chernobyl accident, not one state has submitted a formal claim in international fora against the USSR for damage from the radioactive fallout, although a few have reserved

14 *Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Under Water*, opened for signature 5 August 1963 480 UNTS 43 (entered into force 10 October 1963) ('*Test Ban Treaty*').

15 IAEA Bulletin (1973), *10: Test Ban Treaty*, 5 Aug. 1963 pp. 3, 8, 17 (series of articles commemorating the tenth anniversary of the signing of the Treaty and containing a list of ratifying states from 1963). Online. Available HTTP: <http://www.iaea.org/Publications/Magazines/Bulletin/Bull154/15403500322.pdf> (accessed 31 October 2011).

16 *Nuclear Tests Case (Austr. v. Fr.)*, 1974 ICJ Rep. 253; *Nuclear Tests Case (NZ v Fr.)*, 1974 ICJ Rep. 457.

17 *Nuclear Tests Case (Austr. v Fr.)*, 1974 ICJ Rep. 253, para. 49.

18 *Nuclear Tests Case (NZ v Fr.)*, 1974 ICJ Rep. 457, para. 28.

19 *Nuclear Tests Judgment (Austr. v Fr.)*, 1974 ICJ Rep., 253, paras 33–47, *Nuclear Tests Judgment (NZ v Fr.)*, 1974 ICJ Rep. 457 paras 33–53.

20 *Nuclear Tests Judgment (Austr. v Fr.)*, 1974 ICJ Rep., 253, paras 47–62, *Nuclear Tests Judgment (NZ v Fr.)*, 1974 ICJ Rep. 457, paras 58–62.

21 The decision disposing of New Zealand's case specified that, while it was not the Court's function to contemplate that France would not comply with its own announcements, New Zealand could request an examination of the situation if the basis for the dismissal of the cases somehow changed. *Nuclear Tests Judgment (NZ v Fr.)*, para. 63. New Zealand invoked this statement to ask the Court to reopen the case when France announced it would begin underground nuclear tests in 1995. *Request for Examination of Situation in Accordance with Paragraph 63 of Court's Judgment of 20 December 1974 in the Nuclear Tests (NZ v Fr.)*, 1995 ICJ 288, 342, 412.

22 *Nuclear Tests Case (NZ v Fr.)*, 1995 ICJ 288, 306.

the right to do so.[23] Nonetheless, a handful did assert that an obligation to compensate for nuclear damage could be established under customary international law,[24] presumably along the lines of the finding in the Trail Smelter case and Principle 21/2, which recognise a general duty to prevent and indemnify transboundary harms. In a 1996 advisory opinion, the International Court of Justice affirmed that this principle has achieved customary law status: 'the general obligation of states to ensure that activities within their jurisdiction and control respect the environment of other states or of areas beyond national control is now part of the corpus of international law relating to the environment.'[25] Questions remain, however, about the level of damage required to trigger the obligation. Some indication may be found in the key treaty regimes that the international community has developed for the protection of the atmosphere.

Long-range transboundary air pollution

Customary rules are, by their very nature, general and incapable of providing very specific guidance. For this reason, states rely on treaties – written agreements that are legally binding upon all states that elect to become parties to the treaty – to set forth their precise rights and responsibilities. In general, international environmental laws in the field of atmospheric pollution follow a common regulatory model:

1) The adoption of a general comprehensive framework; followed later by
2) The adoption of protocols to address more specific topics and obligations.

Parties regularly adopt a preliminary framework convention of very broad and general application and then use it, in turn, to create a forum for the negotiation of more concrete commitments in later protocols.[26] This regulatory technique provides flexibility, in so far as states are free to either take the lead on a particular issue or take more of a wait-and-see approach, and it also enables states to deal with new problems as they arise.

23 See e.g. EEC Internal Market Memorandum # 1221, 14 May 1986, at 15 (discussing statements of West German Chancellor Kohl that he would seek reparations from the Soviet Union). For a more detailed discussion of the international response to the accident, see L.A. Malone, 'The Chernobyl Accident: A Case Study in International Law Regulating State Responsibility for Transboundary Nuclear Pollution', *Columbia Journal of Environmental Law* 12, 1987, 203; Tokyo Summit Declaration on the Implications of the Chernobyl Nuclear Accidents (1986), INFCIRC/333, 5 May 1986, reprinted in 'International Organizations and Agreements', 37 *Nuclear Law Bulletin* 37; E.B. Moynagh, 'The Legacy of Chernobyl: Its Significance for the Ukraine and the World', *Boston College Environmental Affairs Law Review* 21, 1994, 709.

24 When the Director General of the International Atomic Energy Agency requested country comments on international liability for damage arising from a nuclear accident back in 1987, 5 of the 32 countries that responded indicated a belief that sufficient customary international law rules and principles existed to establish liability: Canada, Chile, Germany, Guatemala and Thailand. International Atomic Energy Agency document GOV/INF/550 (1987).

25 *Legality of the Threat or Use of Nuclear Weapons*, Advisory Opinion, ICJ Reports 1996, p. 242, Art. 29.

26 The 'comprehensive framework with protocols' approach is borrowed from international human rights law, as exemplified by such frameworks as those surrounding the *International Covenant on Civil and Political Rights*; the *International Covenant on Economic, Social and Cultural Rights*; and the *Convention on the Rights of the Child*.

This model was pioneered by the first major treaty regime on air pollution, which aims to prevent and reduce acid rain.[27] By the early 1970s, acid rain had become a severe problem in Europe, particularly with the acidification of Scandinavian lakes. In 1979, 32 European countries, along with the US and Canada,[28] adopted the *Convention on Long Range Transboundary Air Pollution* (CLRTAP) within the United Nations Economic Commission for Europe.[29] The 1979 Convention sets out a regional framework for countries to cooperate to address the issue of long-distance acid rain.

An important feature of the Convention is its wide scope, in terms of pollution covered. While its title refers to transboundary air pollution, its provisions apply simply to 'air pollution', meaning that its application is not dependent on proof that a pollutant has crossed a state boundary.[30] Furthermore, the definition of air pollution does not include any requirement of a particular type, level or severity of harm, giving the CLRTAP a very broad range of potential applications beyond just acid rain.[31] The Convention calls on the parties to 'limit, and, as far as possible, gradually reduce and prevent air pollution, including long-range transboundary air pollution'.[32] Notably, this obligation contains no specific reduction target or timetable, but rather a soft commitment on the part of the parties to try and lessen air pollution. Obligations to develop policies and strategies are tempered with language that they be compatible with balanced development and economically feasible.[33] Parties are also committed, *inter alia*, to initiate and cooperate on research into and development of new technologies, instruments and models; to exchange information on their domestic emissions and policies; and to notify and consult with one another in the event of significant risk of LRTAP.[34]

Despite the soft nature of the obligations it contains, the CLRTAP has proved very valuable as a framework for cooperation and the development of more specific measures and obligations. It serves as a starting point for research and monitoring of troublesome emissions as well as for coordination, information exchange and consultation between the countries; and has provided the venue for the elaboration of eight protocols since its entry

27 Acid rain is precipitation that contains elevated levels of nitric and sulphuric acids from the combustion of fossil fuels and can acidify water bodies; damage trees, forest soils, building materials and surfaces, statues and sculptures; and degrade visibility and human health. For an in-depth overview of the science of acid rain, see P. Brimblecombe and H. Hara (eds) *Acid Rain – Deposition to Recovery*, New York: Springer, 2010; C.N. Lane, *Acid Rain: Overview and Abstracts*, Hauppuge, NY: Nova Science Publishers, 2003.

28 United Nations Economic Commission for Europe, 'Status of the Convention on Long-range Transboundary Air Pollution and its Related Protocols (as of March 1, 2011)'. Online. Available HTTP: <http://www.unece.org/env/lrtap/status/lrtap_st.html> (accessed 31 Oct. 2011).

29 *Convention on Long Range Transboundary Air Pollution*, opened for signature 13 November 1979, 1302 UNTS 217 (entered into force 16 March 1983) ('CLRTAP').

30 CLRTAP, Art. 2.

31 CLRTAP, Art. 1, para. a.

32 CLRTAP, Art. 2.

33 CLRTAP, Art. 6.

34 CLRTAP, Art. 4.

into force in 1983.[35] Three of the protocols warrant mention here, for innovating a cost-sharing arrangement for scientific monitoring and introducing flexible regulatory techniques and compliance controls that have since become enduring approaches in international environmental law.

The 1984 Geneva Protocol[36] provides for the financing of the joint monitoring programme called for under Articles 9 and 10 of the Convention. The European Monitoring and Evaluation Programme (EMEP) has three main components: gathering emission data, measuring air quality, and modelling atmospheric dispersion.[37] Prior to the agreement of this Protocol, EMEP was reliant on funding from the United Nations Environment Programme (UNEP), which was set to expire in 1984, and voluntary country contributions.[38] Recognising the need for greater and more stable and predictable funding, the Protocol establishes mandatory contributions for all contracting parties and a General Trust Fund into which all contributions are deposited, to cover the annual costs of this vital programme.[39]

The 1991 Geneva Protocol,[40] which deals with emissions of volatile organic compounds (VOCs), is notable for adopting a more flexible alternative to a uniform target for all countries, under which parties have their choice of three different options for reducing their emissions:

(i) Reduce national annual VOCs emissions levels by at least 30% below 1988 levels or any other annual level from 1984 to 1990 the country may wish;
(ii) Countries that designate tropospheric ozone management areas (TOMAs) have the option of committing to the reductions detailed in (i) for the TOMA alone; and then ensuring that their total national emissions do not exceed 1988 levels by the year 1999; or

35 The eight protocols to the 1979 Convention are:

- 1984 Geneva Protocol on Long-Term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe;
- 1985 Helsinki Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30%;
- 1988 Sofia Protocol Concerning the Control of Emissions of Nitrogen Oxides or their Transboundary Fluxes;
- 1991 Geneva Protocol Concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes;
- 1994 Oslo Protocol on Further Reduction of Sulphur Emissions;
- 1998 Aarhus Protocol on Heavy Metals;
- 1998 Aarhus Protocol on Persistent Organic Pollutants;
- 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-Level Ozone.

36 Protocol to the 1979 LRTAP Convention on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe, 28 September 1984, United Nations, *Treaty Series*, vol. 1491, p. 167, UN Docs EB.AIR/AC.1/4, Annex and EB.AIR/ CRP.1/Add.4 ('EMEP').
37 CLRTAP, Art. 9.
38 EMEP, preamble, p. 1.
39 EMEP, Art. 1, para. 3; Art. 3 paras 1, 2 and 5.
40 Protocol to the 1979 CLRTAP Convention Concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes, opened for signature 18 November 1991, United Nations, Treaty Series, vol. 2001, p. 187 ('Geneva Protocol').

(iii) Countries whose annual emissions in 1988 were below specified thresholds[41] had the further option of just ensuring that their total national emissions do not exceed 1988 levels by the year 1999.[42]

This approach allows the treaty regime to impose commitments based on parties' relative emissions levels and circumstances.

The 1994 Oslo Protocol[43] builds on the flexibility achieved under the VOCs Protocol with minimum targets for each individual country to achieve, according to a staggered timeline of 2000, 2005 and 2010.[44] The individual percentage reductions are based on the actual emissions sources within each country's territory.[45] In place of a uniform inflexible target, these scientifically based targets rely on maps of actual sulphur sources and deposits, thereby maximising both fairness and accuracy. This Protocol also breaks new ground with the establishment of a so-called Implementation Committee to review parties' compliance and implementation of all of the protocols to the 1979 CLRTAP.[46] This exciting development led to the adoption of a full compliance procedure in 1997.[47] As mentioned above, the regulatory legacy of the 1979 Convention is significant, having been among the first instruments in international environmental law to adopt the 'framework convention with protocols' approach. As will be seen, the use of country-specific baselines, targets and timetables is, likewise, replicated in the other two key air pollution regimes designed to protect the ozone layer and combat climate change.

Ozone depletion

Around the same time as evidence was mounting on the dangers of acid rain, scientists were raising alarms about another worrisome environmental problem: depletion of the ozone layer.[48] Like acid rain, ozone depletion is believed to be caused by air pollution – in this case,

41 The thresholds were 1988 VOCs emissions lower than 500,000 tons and 20 kilograms per inhabitant and 5 tons per square kilometre. Geneva Protocol, Art. 2, para. 2(c).
42 Geneva Protocol, Art. 2, para. 2(c).
43 Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Further Reduction of Sulphur Emissions, 14 June 1994, United Nations, *Treaty Series*, vol. 2030, p. 122; UN Doc EB.AIR/R.84; E/ECE/ENHS/001/2002/1 ('Oslo Protocol').
44 Oslo Protocol, Annex II.
45 Oslo Protocol, Art. 8, para. 1.
46 Oslo Protocol, Art. 7.
47 Economic Commission for Europe, Decision 1997/2 Concerning the Implementation Committee, its Structure and Functions and Procedures for Review of Compliance, ECE/EB.AIR/53, 7 January 1998, p. 32.
48 The ozone layer is a layer in the Earth's atmosphere that contains high levels of the colourless gas ozone, and absorbs over 97 per cent of high-frequency ultraviolet light from the sun, sparing the planet's inhabitants from exposure to these potentially damaging rays. By the late 1970s, scientific consensus was growing that the ozone layer was being depleted beyond what normal natural fluctuations could explain, and the primary suspects were two common chemicals: halons, used in fire extinguishers; and chlorofluorocarbons (CFCs), used in aerosol sprays, air conditioners, Styrofoam and solvents. For an in-depth overview of the science of ozone depletion, see Global Ozone Research and Monitoring Project, 'Scientific Assessment of Ozone Depletion: 2010', World Meteorological Organization, Report No. 52, 2010. Online. Available HTTP: <http://www.esrl.noaa.gov/csd/assessments/ozone/2010/chapters/prefaceprologue.pdf> (accessed 2 December 2011).

anthropogenic emissions of chlorofluorocarbons (CFCs) and halons. Unlike acid rain, however, ozone depletion is not a localised problem between neighbouring states; rather, it is a global problem with both producers and users all over the world. Where the CLRTAP had only to address a regional crisis, the ozone regime had to secure buy-in from the whole of the international community, a task of infinitely greater difficulty for the wider range of needs and circumstances that had to be accommodated to achieve consensus. In particular, the ozone negotiations brought to the fore the challenge of reconciling environmental conservation with economic considerations, a rift that cut almost directly along a developed/developing country divide.[49]

By the early 1980s, the US had already acted unilaterally to curb CFCs and was eager for others to follow suit so as not to suffer a disadvantage for not using them. While the Europeans initially expressed scepticism about the scientific evidence, they eventually came on board. The developing countries, however, argued that ozone depletion was largely the result of the historical emissions of the industrialised North, and that it would be unfair to hamper the South's economic growth with burdensome obligations and the outlawing of useful chemicals before they too had a chance to develop. As mentioned above, the reality that ozone-depleting substances threaten the ozone layer equally – regardless of where they are released – meant that any effort to reduce them required a truly global commitment on the part of all states to decrease their production and use, and this meant the developing world had to be brought on board. In March 1985, the international community finally agreed on a framework convention that was similar to the CLRTAP, in so far as it laid out a foundation for countries to meet regularly to review the state and science of the ozone problem, leaving concrete reductions obligations for future protocols. What was different was the special treatment accorded to developing country priorities.

The 1985 *Vienna Convention for the Protection of the Ozone Layer* was the first international treaty focused specifically and exclusively on addressing a global environmental threat.[50] In addition, it is important because it was adopted at a time when the science on ozone depletion was still uncertain: the international community moved forward with efforts to address the problem even though scientific consensus on its causes and solutions was not yet firm. This landmark development unveiled a more precautionary approach to environmental problems that legitimised preventative action to protect the environment. Most critical, however, are its ground-breaking calls for special consideration of the needs of the developing world in the development, exchange and transfer of legal, scientific and technical knowledge. The international regime on the ozone layer is remarkable for the emergence of new and stronger voices from developing countries demanding, and obtaining, a better and fairer bargain in environmental treaties. The principle of common but differentiated responsibility that would be articulated in the Rio Declaration a few years later found one of its earlier concrete applications in this regime.

The Convention establishes a framework of four categories of measures to protect people and the environment from ozone depletion: cooperative monitoring; research; policy development; and implementation of the international regime.[51] As a framework convention, it

49 For an in-depth account of the ozone negotiations, see R. Benedick, *Ozone Diplomacy New Directions in Safeguarding the Planet*, Cambridge, MA: Harvard University Press, 1998.

50 *Vienna Convention for the Protection of the Ozone Layer*, opened for signature 22 March 1985, TIAS No 11, 1513 UNTS 293 (entered into force 22 September 1988) ('Vienna Convention') 324.

51 Vienna Convention, Art. 2(2).

imposes no concrete obligations to reduce ozone-depleting substances and, adopting the flexibility of the 1979 CLRTAP, makes states' individual obligations dependent upon their respective means and capabilities, as well as the latest scientific and technological knowledge.[52] To encourage the developing countries to ratify, the treaty also accords special consideration to their needs and situation, and specifies that even the meagre commitments it contains are to be imposed 'in accordance with the means at [countries'] disposal and their capabilities'.[53] With this compromise, the developing countries' participation was secured, providing the needed assistance in meeting their obligations under the Convention and assurances that their participation would not decelerate economic growth and development.

Mere months after the approval of the Convention in 1985, a team of scientists with the British Antarctic Survey published findings of a hole in the ozone layer over Antarctica roughly the size of the continental US.[54] This startling discovery spurred the immediate initiation of negotiations for concrete measures to reduce ozone-depleting substances, leading to the agreement of the *Montreal Protocol on Substances that Deplete the Ozone Layer* in late 1987.[55] Like its parent convention, the Protocol was a ground-breaking instrument with innovative regulatory, institutional and financial arrangements.[56]

While consensus had been achieved on the need to address ozone depletion, the negotiators of the Protocol still had to contend with difficult questions as to where reductions should be made and who should pay for them. In particular, the developing countries remained adamant that they should be able to transition comfortably to alternative chemicals, technologies and industries without any harm to their economies. As a result, the Protocol granted developing countries a ten-year grace period in which they were permitted to increase consumption of the regulated chemicals to meet their 'basic domestic needs', before coming under the Protocol's limitations and reductions on consumption and production.[57] In addition, the Protocol called for the 'provision of subsidies, aid, credits, guarantees or insurance programmes . . . for the use of alternative technology and for substitute products'.[58] Despite these incentives, key developing nations, particularly China and India, still refused to ratify and forced the adoption of several considerable amendments in 1990.[59] The 1990 amendments further revolutionised international environmental regulation, with new approaches to the enduring obstacles of financial assistance, differentiated obligations and compliance incentives.

52 Vienna Convention, Art. 2(2), (4).
53 Vienna Convention, Art. 2(2).
54 British Antarctic Survey, 'The Ozone Hole', Natural Environment Research Council Science Briefing, 2010. Online. Available HTTP: <http://www.antarctica.ac.uk/press/journalists/resources/science/the_ozone_hole_2009.pdf> (accessed 30 November 2011).
55 *Montreal Protocol on Substances that Deplete the Ozone Layer*, opened for signature 16 September 1987, 1522 UNTS 3 (entered into force 1 January 1989) ('Montreal Protocol').
56 For detailed discussion of the Montreal Protocol, see J.T.B. Tripp, 'The UNEP Montreal Protocol: Industrialized and Developing Countries Sharing the Responsibility for Protecting the Stratospheric Ozone Layer', *New York University Journal of International Law and Politics* 20, 1998, 733; J. Lammers, 'Efforts to Develop a Protocol on Chlorofluorocarbons to the Vienna Convention for the Protection of the Ozone Layer', *Hague Yearbook of International Law* 1, 1998, 255.
57 Montreal Protocol, Art. 5(1).
58 Montreal Protocol, Art. 5(3).
59 *Adjustments and Amendments to the Montreal Protocol on Substances That Deplete the Ozone Layer*, opened for signature 29 June 1990, 30 ILM 537 (entered into force 10 August 1992) ('Montreal Amendments').

The 1990 amendments imposed a deadline on the ten-year grace period: in order to benefit from the considerable aid, insurance and subsidies promised, states had to ratify the Protocol by 1 January 1999.[60] At the same time, however, the Protocol was also amended to explicitly tie developing countries' performance to receipt of sufficient financial and technological support from the developed world,[61] and establish a dedicated financial mechanism to coordinate the transfer of funds and technologies.[62] These were landmark developments, conditioning developing states' performance on the satisfaction of support obligations placed on the North and creating an entirely new fund to cover all incremental costs. The governance of the new fund is also significant: it operates under the authority of *all* the parties, and together they decide on its overall policies and select the members of an Executive Committee, which is tasked with developing and monitoring the implementation of the fund, on the basis of balanced representation of the parties.[63] Finally, a new Article was added containing express language calling on the parties to ensure that 'the best available, environmentally safe substitutes and related technologies are expeditiously transferred to the [developing] Parties . . . and that the transfers . . . occur under fair and most favourable conditions'.[64]

These developments reflect the growing recognition in international law on the atmosphere, and on the environment overall, of the close relationship between environmental conservation and development and the need to find approaches to harmonise both. The ozone regime achieved global participation through an optimal combination of impelling incentives and a compelling deadline. The result has been an extremely successful international regime that demonstrates how a well-designed carrot-and-stick approach can marshal universal consensus and compliance.

Climate change

Building on the precautionary approach modelled by the ozone regime, international efforts began in the late 1980s to coordinate research and exchange on another troubling environmental phenomenon: global warming.[65] In 1988, UNEP and the World Meteorological Organization (WMO) established the Intergovernmental Panel on Climate Change (IPCC) to assess the scientific basis for global action to address climate change.[66] In its first report, released in 1990, the IPCC found sufficient scientific consensus to conclude, firstly, that global average temperatures were rising; and, secondly, that these increases were outside the

60 Montreal Amendments, Art. 5(1).
61 Montreal Amendments, Art. 5(5).
62 Montreal Amendments, Art. 10(1).
63 Montreal Amendments, Arts 10(4) and (5).
64 Montreal Amendments, Art. 10A.
65 The earth's temperate climate is regulated by atmospheric concentrations of what are known as greenhouse gases (GHGs): gases that allow the sun's visible rays to penetrate the atmosphere, but then trap them when they radiate back off the surface of the planet as heat. As GHG concentrations rise, more heat is trapped, leading to an increase in global average temperatures. In the early days, this phenomenon was termed 'global warming', but this phrase has since been phased out in favour of 'climate change', which encompasses a wider range of variations in the earth's climate patterns beyond temperature rise. For an in-depth overview of the science of climate change, see R.K. Pachauri and A. Reisinger (eds) *Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Geneva: IPCC, 1997.
66 *Protection of Global Climate for Present and Future Generations of Mankind* (1989), GA Res. 43/53, UN GAOR, 43rd Sess, UN Doc A/RES/43/53.

range of natural fluctuations and could be attributed to human activities.[67] As in the case of ozone depletion, these findings were cause for great concern for the health of the planet: scientists cautioned that unchecked increases in greenhouse gas (GHG) levels could have terrible consequences, including rising sea levels, increases in the frequency and severity of extreme weather events, water scarcity and famine.[68] Where ozone depletion involved a set of chemicals used in some packaging and appliances of modern convenience, climate change implicated almost every human activity: the culprit was the burning of the fossil fuels on which humans primarily rely for electricity, transportation and industry. Climate change involves more than the environment: it requires a fundamental change in the global economy. The stakes in the international negotiations on this issue, therefore, could not be higher; indeed, some argue that this regime is among the most crucial in the world.[69]

Shortly following the release of the first IPCC report, an International Negotiating Committee was established under the auspices of the UN General Assembly to negotiate a framework convention on climate change.[70] The negotiations were long and difficult.[71] Climate change exploded the traditional alliances within the developed and developing country blocks. In Vienna and Montreal, the lines had been drawn cleanly along a North/South divide, but no more. A North/South split still persisted: developing countries argued that climate change was primarily the result of historical emissions from the industrialized North and, therefore, reductions should be imposed there first, so as not to impede the South's ongoing development. Among the developing countries, however, some parties' interests were diametrically opposed: for instance, the small island states that faced submersion from rising sea levels and the oil-producing companies whose exports would collapse if fossil fuel use declined.

Consensus was as hard to come by in the Northern bloc, where the US and Europe clashed over which gases should be regulated and to what extent. Another fundamental disagreement arose around the South's demands that obligations be governed by historical contributions. While the Europeans were prepared to take the lead in reducing emissions, the US insisted that developing country emissions had to be restricted as well, both to protect its own

67 IPCC, 'Scientific Assessment of Climate Change', in J.T. Houghton, G.J. Jenkins and J.J. Ephraums (eds) *Contribution of Working Group I to the First Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge: Cambridge University Press, 1990.

68 Ibid.

69 P.L. Joffe, 'The Dwindling Margin for Error: The Realist Perspective on Global Governance and Global Warming', *Rutgers Journal of Law and Public Policy* 5, 2007, 89; A. Gore, Nobel Peace Prize Lecture, 10 Dec. 2007. Online. Available HTTP: <http://www.nobelprize.org/nobel_prizes/peace/laureates/2007/gore-lecture_en.html> ('We, the human species, are confronting a planetary emergency – a threat to the survival of our civilization that is gathering ominous and destructive potential even as we gather here'); K. Ban, Secretary-General's Message on the International Day for the Preservation of the Ozone Layer, 16 September 2009. Online. Available HTTP: <http://www.un.org/apps/sg/sgstats.asp?nid=4069> ('Without action on climate change, the world faces profound social, economic and environmental disruption').

70 *Protection of Global Climate for Present and Future Generations of Mankind* (1990), GA Res. 45/212, UN GAOR, 45th Sess, UN Doc A/RES/45/212.

71 For an in-depth account of climate politics and negotiations, see US Climate Action Centre, *Copenhagen Climate Negotiations: The Briefing Book*, 2009. Online. Available HTTP: <http://www.usclimatenetwork.org/resource-database/biefingbook_basics.pdf> (accessed 2 December 2011); H. Schroder, *Negotiating the Kyoto Protocol: An Analysis of Negotiation Dynamics in International Negotiations*, London: Lit Verlag, 2001; I.M. Mintzer and J.A. Leonard (eds) *Negotiating Climate Change: The Inside Story of the Rio Convention*, Cambridge: Cambridge University Press, 1994.

industries and to ensure that reductions achieved in the North were not erased by emissions unabated below the Equator. As in the case of the ozone layer, the negotiations were further complicated by the significant scientific uncertainty that remained – no one could say definitively what the climate's critical breaking point for GHG concentrations was or what would happen if that limit was breached – and the debates were very intense. Unable to agree on actual commitments to reduce GHG emissions, the international community agreed a framework treaty, the *United Nations Framework Convention on Climate Change* (UNFCCC), that laid the foundation for stronger action down the road.[72]

The UNFCCC centres on three main principles: the precautionary approach,[73] sustainable development,[74] and a relative newcomer in international environmental law, known as common but differentiated responsibility (CDR).[75] Precaution, familiar from the ozone regime, provides that, where there are threats of serious or irreversible damage, lack of scientific certainty should not preclude cost-effective measures to prevent damage to the environment.[76] Sustainable development calls simply for development that meets the needs of the present without compromising those of future generations.[77] There are two main elements of CDR: first is the recognition of all states' shared interest in and responsibility for protecting the global environment.[78] Second is the recognition that it is also necessary to consider states' individual circumstances: both their contribution to the creation of the environmental problem at hand, and their relative ability to prevent or reduce the threat, in terms of their financial and technological capabilities.[79] Taken together, these three principles formed the basis for the substantive provisions of the Convention.

The UNFCCC sets as its aim the stabilisation of GHGs at levels that would prevent dangerous anthropogenic interference with the planet's climate.[80] To this end, it calls on all nations to, *inter alia*, look into the issue, monitor emissions and share their findings with one another.[81] It then imposes additional obligations on the developed countries only,[82] requiring them to affirmatively 'take the lead' with domestic emissions-reducing policies and measures;[83] commit new and additional funding for the climate regime;[84] assist vulnerable developing countries in meeting the costs of adaptation;[85] and promote, facilitate and finance resource and technology transfers to the developing world, to support them in meeting their commitments under the convention.[86] As under the ozone regime, developing countries'

72 United Nations Framework Convention on Climate Change, opened for signature 4 June 1992, 1771 UNTS 107 (entered into force 21 March 1994) ('UNFCCC').
73 UNFCCC, Art. 3, para. 3.
74 UNFCCC, Art. 3, para. 4.
75 UNFCCC, Art. 3, para. 1.
76 Sands, *Principles of International Environmental Law*, op. cit., p. 268.
77 Ibid.
78 Ibid.
79 Ibid.
80 UNFCCC, Art. 2.
81 UNFCCC, Art. 4(1).
82 UNFCCC Annexes I and II, which list the countries that are subject to additional obligations under the Convention, contain the OECD countries and certain so-called 'economies in transition' in Eastern Europe; and then just the OECD countries, respectively.
83 UNFCCC, Art. 4(2)(a).
84 UNFCCC, Art. 4(3).
85 UNFCCC, Art. 4(4).
86 UNFCCC, Art. 4(5).

performance of their obligations is expressly conditioned on receipt of financial and technical support;[87] all parties are required to take into consideration what actions are needed to meet the needs and concerns of the developing world;[88] and a financial mechanism is established to facilitate financial and technological transfers.[89] Soon after the adoption of the Convention, negotiations began on a protocol that would impose concrete GHG emission reduction targets and timetables.

The first and only protocol to the Convention to date, the 1997 *Kyoto Protocol to the United Nations Framework Convention on Climate Change*,[90] is also first in setting country-specific targets in an international instrument and devising a highly innovative and, for some, controversial market-based approach.[91] While the developing countries do not undertake any new commitments beyond their existing monitoring and cooperation obligations under the UNFCCC,[92] the Kyoto Protocol imposes individualised reduction targets for each developed country.[93] The Protocol negotiations involved protracted political weighing of each country's respective emission levels and capacity for cuts, to achieve an overall reduction of 5 per cent below 1990 levels by 2012.[94] Kyoto also laid the foundation for the creation of a global carbon market with the creation of three new market-based mechanisms to enable the international community to reduce emissions in the most efficient and cost-effective ways possible. First, it pioneered an emissions trading mechanism, under which parties can buy and sell emission credits.[95] Then it introduced two other mechanisms that enable developed countries to fund emissions-reducing projects wherever they are least expensive: in other developed countries, under Joint Implementation;[96] and in developing countries, under the Clean Development Mechanism (CDM).[97] Protracted political disagreements that delayed the Protocol's entry into force until 2005[98] and numerous trial-and-error attempts to operationalise its mechanisms have made it difficult to measure the success of the market-based regulation, but it remains an exciting – if still unproven – new approach in international environmental law.[99]

87 UNFCCC, Art. 4(7).
88 UNFCCC, Art. 4(8).
89 UNFCCC, Arts 11 and 21. Article 11 specifies that the mechanism should have an 'equitable and balanced representation of all Parties within a transparent system of governance', and refers to interim arrangements in Article 21, which calls for the Global Environment Facility (GEF) to be entrusted with the operation of the financial mechanism on an interim basis. The GEF was restructured to make its membership universal in order to fulfil the Article 11 requirements, and remains the financial mechanism for the UNFCCC as of this writing.
90 *Kyoto Protocol to the United Nations Framework Convention on Climate Change*, opened for signature 10 December 1997, 37 ILM 22 (entered into force 16 February 2005) ('Kyoto Protocol').
91 While a first in international environmental law, the cap-and-trade approach adopted by the protocol was based on a very promising sulphur dioxide trading scheme that had just been developed in the United States. N.O. Keohane, 'Cap-and-Trade is Preferable to a Carbon Tax', in R.B. Stewart, B. Kingsbury and B. Rudyk (eds) *Climate Finance: Regulatory and Funding Strategies for Climate Change*, New York: New York University Press, 2009, p. 58.
92 Kyoto Protocol, Art. 10.
93 Kyoto Protocol, Annex B.
94 Kyoto Protocol, Art. 3(1).
95 Kyoto Protocol, Art. 17.
96 Kyoto Protocol, Art. 6.
97 Kyoto Protocol, Art. 12.
98 Kyoto Protocol, Art. 25.
99 For further consideration of the climate change regime, see Chapter 20 by A. Zahar in this volume.

Looking ahead, negotiations are ongoing for a successor protocol to Kyoto, which is set to expire at the end of 2012. One key issue is the future of the global market approach. While scientific evidence and consensus on the seriousness of climate change has been building the world over, lack of political will has thwarted domestic regulation efforts in key countries and the international regime as well. Even now that several of the major emitters among the developing countries have signalled a willingness to consider reduction commitments, the potential for a truly global market remains very much in the air. In its place, countries are pursuing domestic and regional regimes, a prime example being the European Union's Emission Trading Scheme. California, Japan, China and South Korea have all announced plans to launch their own schemes in the near future, raising the question of whether efforts will end at the national and regional levels, or ever merge into a truly global scheme.

Discussion is also well under way on two new mechanisms: reduced emissions from deforestation and degradation (REDD) and nationally appropriate mitigation actions (NAMAs). The former contemplates assigning a financial value to the carbon stored in forests and offering incentives for countries, particularly those in the developing world, to conserve forest resources, practise sustainable management, and even increase forest stocks,[100] while NAMAs could potentially complement (or replace) the project-based CDM with a mechanism to facilitate financial support and technology transfers for nationwide mitigation standards and initiatives in the developing world. All eyes are now on the Conference of the Parties/Meeting of the Parties, which, it is hoped, will continue to build on the great legacy of international cooperation and innovation in addressing atmospheric pollution, with an agreement on these exciting new mechanisms, as well as a future for the global climate regime as a whole.

Conclusion

The regulation of atmospheric pollution in international law has come a long way, evolving from a few general rules into several complex treaty regimes dealing with some of the most challenging global environmental problems confronting our planet. International rules have shown their ability to effectively address atmospheric pollution with the proven financial and regulatory approaches innovated in the arenas of transboundary air pollution and ozone depletion. At the same time, however, the flagging climate change negotiations point to several potential limitations, particularly when the costs are high and the stakes uncertain. International environmental law is at a critical crossroads: its continuing relevance depends upon its ability to address pressing global environmental challenges. Imaginative ideas and solutions are called for. With the necessary political will, international environmental law can no doubt rise to the challenge.

100 REDD is explored further in Chapter 39 by R. Maguire in this volume.