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Protection of the Stratospheric Ozone Layer and the Structure of International Environmental Lawmaking

By DAVID D. CARON*

I. INTRODUCTION

As concern for the global environment grows, there is both under-way and planned a flurry of international environmental lawmaking efforts. Protection of the stratospheric ozone layer is an area in which there already has been a relatively large amount of lawmaking activity. This Article in Part I briefly reviews the stratospheric ozone depletion problem and the history of the international community's response to that threat. This review and history has been treated extensively and competently elsewhere.¹ In this sense, it is not the purpose of Part I to duplicate such work, but rather to provide the reader with an appreciation of the concerns and trends that have marked the community's response. Part II provides a restatement of the regime for the protection of the stratospheric ozone layer as it presently exists under the 1985 Vienna Convention,² the 1987 Montreal Protocol,³ and the 1990 London Adjustments and Amendments to that Protocol.⁴ Finally in Part III, I briefly

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This Article on the current status of the international regime for the protection of the stratospheric ozone layer was solicited by the *Annuaire Français de Droit International* and published in French as *La protection de la couche d'ozone stratosphérique et la structure de l'activité normative internationale en matière d'environnement*, 36 *ANNUAIRE FRANÇAIS DE DROIT INTERNATIONAL* (1990) (forthcoming).

1. See, e.g., S. ROAN, *ODONE CRISIS: THE 15-YEAR EVOLUTION OF A SUDDEN GLOBAL EMERGENCY* (1989).

2. Vienna Convention for the Protection of the Ozone Layer, *opened for signature* Mar. 22, 1985, U.N. Doc. UNEP/IG.53/Rev.1, at 11 (1985), S. TREATY DOC. 9, 99th Cong., 1st Sess. (1985), *reprinted in* 26 I.L.M. 1529 (1987) [hereinafter Vienna Convention].

3. Montreal Protocol on Substances that Deplete the Ozone Layer, *opened for signature* Sept. 16, 1987, S. TREATY DOC. 10, 100th Cong., 2d Sess. (1987), *reprinted in* 26 I.L.M. 1550 (1987) [hereinafter Montreal Protocol].

4. *Report of the Second Meeting of the Parties to the Montreal Protocol on Substances that*

reflect on what the community's experience with the ozone depletion problem tells us concerning the evolving structure of lawmaking in the international environmental area.⁵

II. STRATOSPHERIC OZONE DEPLETION: THE PROBLEM AND A BRIEF HISTORY OF THE INTERNATIONAL RESPONSE

A. The Stratospheric Ozone Layer and The Theory That It Could Be Depleted⁶

A diffuse layer of ozone⁷ in the upper reaches of our atmosphere has shielded life on the planet from ultraviolet radiation⁸ for millions of years. A seemingly unrelated event in 1928 was the development of chlorofluorocarbons (CFCs) by Dupont chemists. These extremely stable and consequently long-lived substances were hailed as technological triumphs. If one recurrent theme in the effort to protect the ozone layer is uncertainty as to the reality or extent of a threat, then it is noteworthy that for almost fifty years after the discovery of CFCs, the community was ignorant of the threat CFCs posed and, as a consequence, focused only upon the benefits they accorded. CFCs came to be used in a multitude of ways, and the amount and types of CFCs utilized grew dramatically, first after the World War II and again in the late 1960s.⁹

In 1974 however, two scientists postulated that these stable sub-

Deplete the Ozone Layer, U.N. Environment Programme (Agenda Item 7), U.N. Doc. UNEP/OzL.Pro.2/3, Annex II (1990) [hereinafter *London Amendments*].

5. See also P.H. SAND, LESSONS LEARNED IN GLOBAL ENVIRONMENTAL GOVERNANCE (1990) (addressing innovations in standard setting and implementation).

6. For a succinct description of the problem, see Rowland, *Stratospheric Ozone Depletion by Chlorofluorocarbons*, 19 AMBIO 281 (1990); Gribbin, *The Ozone Layer*, NEW SCIENTIST, May 5, 1988, Inside Science No. 9, at 1.

7. Ozone is an unstable gas composed of three atom oxygen molecules, which tends to break down into the two atom oxygen molecules which we breathe. Ozone nonetheless exists in the stratosphere because ultraviolet radiation (from which we are shielded by the ozone layer) creates ozone by breaking apart diatomic oxygen. This ozone eventually returns spontaneously to its more stable two atom configuration. But amidst this cycle there is a resultant layer of ozone. Crucially important to one's understanding is the fact that the ozone layer operates as a shield even though the concentration of ozone is only about one molecule in every 100,000. The concentration is so small that human activities have the potential to disrupt it.

8. Light from the sun covers a range of energies. Light which appears blue to the human eye, for example, is more energetic than light that appears red. Ultraviolet light, with wavelengths from below 200 nanometers up to 350 nanometers and not visible to the human eye, is highly energetic and, consequently, harmful to life.

9. CFCs have been used as propellants for aerosols, refrigerants, solvents for the cleaning of electronic components, and the manufacture of rigid and flexible foams.

stances, for the most part, ultimately reached the stratosphere; that once there, they finally became exposed to the ultraviolet radiation from which they had been shielded by the ozone layer; that this highly energetic radiation broke down the CFC molecule, releasing chlorine atoms; and that such chlorine atoms then served as catalysts in reactions which broke down ozone molecules.¹⁰ It was estimated that each chlorine atom released could destroy 100,000 ozone molecules, ultimately depleting the ozone layer and exposing the planet to increased harmful ultraviolet radiation.¹¹

Two responses to this theory quickly emerged. Some experts pointed to the dangers of failing to act quickly to protect the ozone layer. Others pointed to the costs of acting precipitously on the basis of a contested and yet unproven hypothesis. This confrontation became a key characteristic of the debate regarding CFCs and ozone depletion for most of the decade that followed. Moreover, because the issue became a clash of experts which was not accessible to laypeople, there was a lack of shared knowledge concerning the problem that in many ways foreclosed broader public participation.

B. The Focus on Aerosols: 1974 to 1981¹²

Public debate regarding regulation initially focused upon the use of CFCs as propellants in aerosols, a use that clearly resulted in releases of CFCs into the atmosphere. Not without difficulty, a number of states, including the United States,¹³ Canada, and Sweden,¹⁴ moved toward national bans on such aerosols. These efforts at unilateral action added new characteristics to the debate. First, the concern arose in U.S. governmental circles that these unilateral efforts might be counterproductive in that

10. Molina & Rowland, *Stratospheric Sink for Chlorofluoromethanes: Chlorine Atom-Catalyzed Destruction of Ozone*, 249 NATURE 810 (1974). See also Stolarski & Cicerone, *Stratospheric Chlorine: A Possible Sink for Ozone*, 52 CAN. J. CHEMISTRY 1610 (1974).

11. As to the potential harmful effects of increased ultraviolet radiation, see Emmett, *Health Effects of Ultraviolet Radiation*, 1 EFFECTS OF CHANGES IN STRATOSPHERIC OZONE AND GLOBAL CLIMATE 129 (J.G. Titus ed. 1986) [hereinafter 1 STRATOSPHERIC OZONE]; Waxler, *Ozone Depletion and Ocular Risks from Ultraviolet Radiation*, in 1 STRATOSPHERIC OZONE, *supra* at 147; Teramura, *Overview of Our Current State of Knowledge of UV Effects on Plants*, in 1 STRATOSPHERIC OZONE, *supra*, at 165; Worrest, *The Effect of Solar UV-B Radiation on Aquatic Systems: An Overview*, in 1 STRATOSPHERIC OZONE, *supra*, at 175.

12. For a history of this early period, see L. DOTTO & H. SCHIFF, *THE OZONE WAR* (1978).

13. As to U.S. actions then and generally, see Nangle, *Stratospheric Ozone: United States Regulation of Chlorofluorocarbons*, 16 B.C. ENVTL. AFF. L. REV. 531 (1989).

14. As to Swedish actions then and generally, see Ahmadzai & Hedlund, *A Profile of Measures Taken in Sweden to Protect the Stratospheric Ozone Layer*, 19 AMBIO 341 (1990).

the actions of a few states took pressure off other states to do likewise. In other words, there was a free rider problem. Second, because lawmakers and the public often could not judge the debate of experts, governments began undertaking their own studies. These studies provided more impartial and authoritative sources of knowledge regarding the subject. They would take time to complete, but their eventual release would profoundly affect the debate. In some cases, such as in the United States, a study would strongly support regulation efforts,¹⁵ while in other states such as the United Kingdom, the study would have the opposite effect.¹⁶

The national debates, as might be expected, resulted in basically one of two outcomes: states generally inclined to greater regulation of CFCs, and states basically still suspicious of the theory or at least of the need for aggressive immediate action. Those states holding the former view included Canada, Finland, Sweden, and the United States; the latter view was held by much of continental Europe and the United Kingdom.¹⁷ The states holding these two views would coalesce into two groups (respectively the Toronto group and the European Community (EC) group) during the international negotiations which followed, and, would roughly maintain their views and compositions until approximately 1987.

C. UNEP and the 1985 Vienna Framework Convention

Even as the national debates proceeded, the groundwork for an international approach was laid. The United Nations Environmental Programme (UNEP) in 1977 convened a meeting to begin the international process. The meeting resulted in the adoption of the "World Plan of Action on the Ozone Layer" and the establishment of a Global Coordinating Committee on the Ozone Layer.

As U.S. leadership and concern over the ozone problem diminished with the advent of the Reagan administration in 1981, UNEP, as a forum for action, and the UNEP efforts to formulate an international response under its Action Plan, in particular, moved to center stage.¹⁸ In 1981

15. See NATIONAL ACADEMY OF SCIENCES, HALOCARBONS: ENVIRONMENTAL EFFECTS OF CHLOROFLUOROMETHANES (1976).

16. See STRATOSPHERIC RESEARCH ADVISORY COMM., U.K. DEP'T OF THE ENV'T, REPORT ON STRATOSPHERIC OZONE (1976).

17. This should not be taken to mean that the European Communities did nothing, but rather that they were not prepared to do as much. As to actions by the European Community in 1978, 1980, and 1982, see S.P. JOHNSON & G. CORCELLE, THE ENVIRONMENTAL POLICY OF THE EUROPEAN COMMUNITIES 149-51 (International Environmental Law and Policy Series, 1989).

18. For discussions of the UNEP efforts up to and including adoption of the Vienna Convention, see J. BRUNNÉE, ACID RAIN AND OZONE LAYER DEPLETION: INTERNATIONAL

UNEP established an Ad Hoc Working Group of Legal and Technical experts charged with the task of drafting a framework convention for the protection of the ozone layer. A framework convention is a document that aims not at substantive norms, but rather at establishment of the institutional framework that will result in such norms. The Working Group released the first draft of its work in October 1983, and several further drafts were produced prior to the Vienna Conference in March 1985, which ultimately adopted a framework convention.

Adoption of the Vienna Convention was bittersweet, however, because several states had sought more from the Conference. In particular, Finland, Norway, and Sweden circulated a draft protocol to the then developing framework convention (the Nordic Annex) that would have banned aerosol use of CFCs. Meanwhile, changes within the Environmental Protection Agency under the Reagan administration led the United States to join Canada in supporting the Nordic Annex. The EC states opposed the approach taken by the Annex. Ultimately a compromise was reached in the form of a Resolution of the Conference calling for the states to reassemble for the purpose of concluding a protocol regulating CFCs.

D. A Growing Sense of Urgency and the 1987 Montreal Protocol¹⁹

Even as work proceeded in anticipation of a second meeting to adopt a protocol, two important trends were occurring. First, a British research group in May 1985 announced that huge losses in Antarctic ozone had occurred in the springs of 1982, 1983, and 1984.²⁰ By late summer 1985 American satellite measurements, free of certain previous

LAW AND REGULATION 225-53 (1988). Rummel-Bulska, *The Protection of the Ozone Layer Under the Global Framework Convention*, in TRANSBOUNDARY AIR POLLUTION: INTERNATIONAL LEGAL ASPECTS OF THE CO-OPERATION OF STATES 281 (C. Flinterman, B. Kwiatkowska & J. Lammers eds. 1986); Sand, *Protecting the Ozone Layer: The Vienna Convention is Adopted*, ENVIRONMENT, June 1985, at 18; Wassermann, *UNEP: Protection of the Ozone Layer*, 17 J. WORLD TRADE L. 182 (1983).

19. For discussions of the period leading up to and immediately following the Montreal Protocol, see Banks, *The Ozone Convention and Protocol: Further Steps Towards an International Law of the Atmosphere*, RESOURCES: NEWSL. OF THE CAN. INST. OF RESOURCES L., Spring 1988, at 1; Mintz, *Keeping Pandora's Box Shut: A Critical Assessment of the Montreal Protocol on Substances That Deplete The Ozone Layer*, 20 INTER-AM. L. R. 565 (1989).

20. Farmer, Gardiner & Shanklin, *Large Losses of Total Ozone in Antarctica Reveal Seasonal CLO₂/NO_x Interaction*, 315 NATURE 207 (1985). The data supporting this, however, was limited in that measurements were taken at only two points in Antarctica. More importantly, for several months the data was not supported by American satellite measurements.

interpretational errors, confirmed the British findings.²¹ The Antarctic ozone hole created quite a stir in the scientific community since none of the atmospheric models developed up to that point would have predicted such an event. As a result, a massive international research effort was undertaken to determine whether chlorine was responsible for the hole. In this instance, there would not only be theories, but actual measurements of the chlorine in the stratosphere over Antarctica would be taken. In more general terms, the Antarctic hole was significant because, even before the scientific community could confirm that chlorine was responsible for the hole, the public had what in its view was tangible and comprehensible evidence that humanity could fundamentally alter the Earth's atmosphere. As the public increasingly voiced its concern, the states participating in the international negotiations became increasingly receptive not only to a ban on aerosol use, but, more generally, to across the board phased reductions in CFC and halon consumption and production.

The second trend also facilitated the inclination to adopt across the board phased reductions. Specifically, the major producers of CFCs had come to believe that environmentally safe substitutes for CFCs existed, and that it was for each of them in their individual interest to be the first to develop and offer such substitutes. Although it was thought that such substitutes would be several times more expensive than CFCs, it was also thought that there would be a market for them in a world that called for limits on the use of CFCs.²² Simultaneously, numerous large users of CFCs moved to eliminate their reliance on such substances.²³

For these reasons, the Montreal meeting was quite different from the one held only two years earlier in Vienna in that virtually all of the interested parties were now in agreement that some amount of phased reductions was appropriate. Thus, even though the final report of the international study of the Antarctic hole was not yet released,²⁴ a Proto-

21. Stolarski, Krueger, Schoeberl, McPeters, Newman & Alpert, *Nimbus 7 Satellite Measurements of the Springtime Antarctic Ozone Decrease*, 322 NATURE 808 (1986).

22. See generally Morrisette, *The Evolution of Policy Responses to Stratospheric Ozone Depletion*, 29 NAT. RESOURCES. J. 793 (1989); Monastersky, *Decline of the CFC Empire*, 133 SCI. NEWS 234 (1988); Jones, *In Search of the Safe CFCs*, NEW SCIENTIST, May 26, 1988, at 56.

23. This trend continues apace. See, e.g., *Northern Telecom to Phase Out CFCs This Year*, GLOBAL ENVTL. CHANGE REP., Jan. 18, 1991, at 6; *AT&T Eliminates CFC Use in US Manufacturing Facility*, GLOBAL ENVTL. CHANGE REP., Jan. 4, 1991, at 6.

24. Preliminary reports of high chlorine concentrations by the international group in the Antarctic stratosphere did not state that the chlorine was the conclusive cause of the hole. See Shabecoff, *Chlorine Levels Reported High Over Antarctica*, N.Y. Times, Mar. 10, 1987, at C1, col. 1. That is not to say, however, that there was no scholarly literature pointing to chlorine as the cause. See, e.g., McElroy, Salawitch, Wofsy & Logan, *Reductions of Antarctic Ozone Due to Synergistic Interactions of Chlorine and Bromine*, 321 NATURE 759 (1986).

col to the Vienna Convention calling for a fifty percent reduction in the production and consumption of specified CFCs over an approximately ten year period was adopted in Montreal in September 1987.

E. The Antarctic Ozone Hole and the Race to 1990 London Adjustments and Amendments²⁵

But even as states adopted the Montreal Protocol in September 1987, two major concerns were present regarding the instrument. First, the startling findings regarding the Antarctic ozone hole, officially confirmed only after the meeting in Montreal, had not been taken fully into account in the Protocol. The negotiators were frustrated by their apparent inability to draft regimes that kept up with the revelations emerging from the scientific community. They had taken a step forward in Montreal, but they felt that they were always two steps behind in their own understanding of the problem, and at least two steps behind in their response to the problem. Thus, there was a widespread feeling that the Protocol was inadequate and would require revision.²⁶

Second, the early indications by China and India, representing over one-third of humanity, that they would not become parties to the Protocol because of its failure to provide adequate assistance to developing countries, suggested that the international community might not be sufficiently cohesive to comprehensively regulate the matter. As with greenhouse gases, the international community was coming to realize that the atmospheric changes theorized were evidence of the increasing burden of a growing population on the planet, and that all such problems ultimately boiled down to a combination of the number of people in the world and the way they lived. It was apparent that any regime relating to protection of the ozone layer must include highly populated states, whether or not they presently were significant consumers or producers of ozone-depleting substances. This development was particularly important because it marked one of the few times that the industrialized world needed the cooperation and participation of the Third World. This need

25. For articles anticipating the issues that were addressed in London, see Handl, *International Efforts to Protect the Global Atmosphere: A Case of Too Little, Too Late?*, 1 EUR. J. INT'L L. 250 (1990); Nanda, *Stratospheric Ozone Depletion: A Challenge for International Environmental Law and Policy*, 10 MICH. J. INT'L L. 482 (1989); Rosencranz & Milligan, *CFC Abatement: The Needs of Developing Countries*, 19 AMBIO 312 (1990).

26. Regarding the Antarctic ozone hole, see NAT'L AERONAUTICS & SPACE ADMIN., ANTARCTIC OZONE: INITIAL FINDINGS FROM PUNTA AREAS, CHILE (1988); NAT'L AERONAUTICS & SPACE ADMIN., OZONE TRENDS PANEL REPORT (1988); Stolarski, *The Antarctic Ozone Hole*, 258 SCI. AM. 30 (1988).

allowed the third world to raise development and international equity concerns they believed had been unaddressed for too long.

As to the adequacy of the Montreal Protocol, planning for its adjustment and amendment began almost immediately. The political focus on the global environment in general, and on the protection of the ozone layer in particular, was intense from the 1987 Montreal Conference of the Parties to the 1990 London Meeting of the Parties to the Montreal Protocol. Of particular importance at this time, although less publicly dramatic than the Antarctic ozone hole, was the release of a study by the U.S. Environmental Protection Agency asserting that even assuming one hundred percent global participation in the Protocol, the presence of chlorine in the stratosphere would, by the year 2075, increase by a factor of three.²⁷

Amidst these new revelations, the entry into force of the Montreal Protocol on January 1, 1989, was anticlimactic and hardly noticed. At that time, one nation after another was calling for swifter and deeper cuts in the production and consumption of ozone-depleting substances, and in some cases unilaterally adopting such measures. By the opening of the London Meeting in June 1990, the negotiating parties were in agreement not merely on accelerating the phased reductions, but on phasing out entirely the substances specified by the Montreal Protocol.²⁸ The primary issue was whether this phase out should be accomplished by the year 1997 or the year 2000, the latter representing the adjustment ultimately made to the Montreal schedules.²⁹ Simultaneously, evolving scientific knowledge regarding the threat posed by other substances led to the consensus to amend the Protocol so that it would require phase outs of other fully halogenated CFCs and carbon tetrachloride by the year 2000, and a phaseout of methyl chloroform by the year 2005.³⁰ Increased understanding that the substitutes thought to exist at the time of the Montreal Protocol might also be ozone-depleting³¹ and significant

27. J. HOFFMAN & M. GIBBS, FUTURE CONCENTRATIONS OF STRATOSPHERIC CHLORINE AND BROMINE 2 (EPA Rep. 400/1-88/5, 1988). See also Bowman, *Global Trends in Total Ozone*, 239 SCIENCE 48 (1988).

28. See *Helsinki Declaration on the Protection of the Ozone Layer, Report of the Parties to the Montreal Protocol on the Work of Its First Meeting*, May 2, 1989, U.N. Doc. UNEP/OzL.Pro.1/5, app. 1 (1989).

29. See *infra* text accompanying notes 55-61.

30. As to methyl chloroform, see *Montreal Protocol Should Include Methyl Chloroform, Dutch Group Urges*, 13 Int'l Env't Rep. (BNA) 53 (1990); *U.S. Environmental Group Calls for Phase-Out of Methyl Chloroform*, 13 Int'l Env't Rep. (BNA) 53 (1990).

31. See, e.g., *Scientists Warn of Perils Posed by Substitutes for CFCs*, NEW SCIENTIST, June 30, 1990, at 33.

contributors to the greenhouse effect,³² resulted in the designation of these substitutes as "transitional ozone-depleting substances," and in the conclusion that the transitional substances should be phased out by the year 2040, or, if possible, by the year 2020.

The apparent willingness of nonparticipating countries such as China and India to operate outside of what they perceived to be an unjust regime, was pitted against the reluctance of some developed countries such as the United States, to construct new international structures, to recognize a right of such countries to assistance and technology transfer, and to encourage linkages between participation in regimes like the Protocol and recognition of the special situation of developing countries. This reluctance was particularly strong since, at this same time, the developing world was making analogous demands for a global climate change fund.³³ In time, the United States, virtually alone, opposed the establishment of a financial mechanism. In May 1990 an apparently firm refusal to offer new monies to help developing countries phase out ozone-depleting chemicals threatened to derail the London Meeting planned for late June and early July 1990. In mid-June, however, the United States agreed to provide such monies,³⁴ and shifted its focus to the mechanism for the disbursement of such monies, pressing for a controlling voice in how the fund would operate.³⁵ Ultimately, the London meeting adopted amendments to the Protocol that provided for technology transfer, and established a fund under the supervision of a fourteen member committee drawn from the developed and developing world.³⁶ At the conclusion of the London Meeting, the representatives of China and India indicated their countries would sign the Protocol in 1992.³⁷ The reference by these delegates to the 1992 date is significant because it implies a further linkage between their willingness to join the Protocol and the develop-

32. As to the adequacy of the transition period approach, see *Scientist Says Interim CFC Substitute Should Not Increase Stratospheric Chlorine*, 14 Int'l Env't Rep. (BNA) 76 (1991). This possibility is under particular scrutiny. See, e.g., *AFEAS Studies Greenhouse Contribution of CFC Alternatives*, GLOBAL ENVTL. CHANGE REP., Dec. 7, 1990, at 6.

For a tabular summary of the ozone-depleting potential, global warming potential, relative chlorine-loading potential, and reference lifetime of the various species of identified ozone-depleting substances, see Rosemarin, *Some Background on CFCs*, 19 AMBIO 280 (1990).

33. See generally Handl, *supra* note 25.

34. Milore, *US Agrees Extra Funds to Safeguard Ozone Layer*, NEW SCIENTIST, June 23, 1990, at 30.

35. Milne, *Nations Approach Unity on Measures to Protect Ozone*, NEW SCIENTIST, June 30, 1990, at 33.

36. See Rosencranz & Milligan, *supra* note 25, at 314.

37. Milne, *CFC Clampdown Eases Pressure on the Ozone Layer*, NEW SCIENTIST, July 7, 1990, at 21.

ment of a more general climate trust fund at the United Nations Conference on Environment and Development to be held in Brazil in 1992.

F. The Task Ahead

After the London Meeting, two major areas of concern remain. First, a number of groups assert that the Protocol even as adjusted and amended does not go far enough. Although the list of controlled substances has been increased and, for the most part, total phaseouts have been called for, an observer group at the London Meeting noted that the phaseout periods—generally of ten years—will allow the production of another seventeen million tons of ozone-depleting substances.³⁸ Such arguments arise amidst continued findings by the scientific community that the ozone layer continues to deteriorate over Antarctica,³⁹ the Arctic,⁴⁰ and generally,⁴¹ and increasing evidence that the same substances that deplete ozone are major contributors to global warming.⁴²

Second, there is a growing sense that agreement upon the Protocol and its adjustments and amendments, even if not completely satisfactory, may have been an easier task than will be the facilitation, monitoring, and enforcement of its implementation.⁴³

38. See *Report of the Second Meeting of the Parties to the Montreal Protocol on the Substances that Deplete the Ozone Layer*, para. 36, at 10, UNEP/OzL.Pro.2/3, para. 36, at 10 (1990) [hereinafter *Report of the Second Meeting*].

39. See, e.g., *1990 Ozone Hole Continues Into December*, GLOBAL ENVTL. CHANGE REP., Dec. 21, 1990, at 5; Monastersky, *Antarctic Ozone Bottoms at Record Low*, 138 SCI. NEWS 228 (1990) (Antarctic ozone layer hole reaches record proportions); Stevens, *Ozone Losses in Arctic Are Larger Than Expected*, N.Y. Times, Sept. 6, 1990, at A25, col. 1; *Ozone Depletion Quickens at Both Poles*, NEW SCIENTIST Aug. 4, 1990, at 32.

40. See, e.g., *Scientists Detect Hole in Ozone Above Three Scandinavian Nations*, 14 Int'l Env't Rep. (BNA) 68 (1991).

41. See, e.g., Stevens, *Ozone Loss Over U.S. is Found to be Twice as Bad as Predicted*, N.Y. Times, Apr. 5, 1991, at A1, col. 1; Shabecoff, *Scientists Report Faster Ozone Loss*, N.Y. Times, June 24, 1990, § 1, at 13, col. 1 (Sunday late ed.) (10% reduction in ozone since 1967 over middle latitudes).

42. See, e.g., *Total CFC Ban Needed to Halt Global Warming*, NEW SCIENTIST, Sept. 8, 1990 (CFCs will soon overtake carbon dioxide as the principal contributors to the increase in the greenhouse effect); Leggett, *Playing Roulette with the Atmosphere*, NEW SCIENTIST, July 7, 1990, at 16 (the Intergovernmental Panel on Climate Change Report indicts CFCs and many of their "substitutes" because of their contribution to global warming).

43. Additional issues on the horizon are other ozone-depleting activities such as proposals for stratospheric supersonic aircraft, see, e.g., Gribbin, *Supersonic Plans 'Threaten Ozone Layer'*, . . . , NEW SCIENTIST, June 9, 1990, at 24, military use of ozone-depleting substances (a category of use not clearly encompassed within the Protocol), and apparent difficulties in phasing out CFC use by vessels, see, e.g., *CFC Phaseout Schedules Present Special Problems for Ships*, GLOBAL ENVTL. CHANGE REP., Dec. 7, 1990, at 7.

For discussions of how the international regime should be implemented in the United States, see Chafee & Shimberg, *Supplementing the Montreal Protocol: The Need for Domestic*

III. A RESTATEMENT OF THE REGIME

A. The Organization of the Regime

There are two main strands to the international organizational scheme created by the Vienna Convention and the Montreal Protocol, as amended and adjusted. First, there are state parties (to the Convention, to the Protocol, and to the Protocol as amended) who meet on a regular basis and who in smaller groups meet more regularly for particular tasks. Second, there is a Secretariat which fulfills a number of duties, occasionally through ad hoc working groups, assigned to it by the state parties in the Convention and Protocol.

With respect to the parties to the ozone protection regime, there are three formal groups of parties. First, the Vienna Convention establishes a "Conference of the Parties."⁴⁴ Second, although no special name such as "Conference" is given, the term "Parties" in the Montreal Protocol means only the parties to that Protocol.⁴⁵ Third, because the Protocol was amended in London, there may be slight divergences between those states party to the Protocol and those states party to the Protocol as amended. Inasmuch as a party to the Protocol or the Protocol as amended must also be a party to the Convention, the parties to the Protocol or the Protocol as amended are subgroups of the "Conference of the Parties" to the Convention.

Both the Convention and the Protocol provide that there shall be regular meetings of the parties to the respective instruments.⁴⁶ As a practical matter, these groups of parties coordinate their meetings, and the Montreal Protocol generally calls for the meetings of Parties to the Protocol to be held in conjunction with the meetings of the Conference of the Parties to the Convention.⁴⁷ The primary distinction between the groups of parties thus reduces their standing to vote upon, or have an official voice regarding, certain issues. In particular, only Parties to the Protocol, and not those who are solely members of the Conference of the

Legislation, 19 AMBIO 310 (1990); Hahn & McGartland, *The Political Economy of Instrument Choice: An Examination of the U.S. Role in Implementing the Montreal Protocol*, 83 NW. U.L. REV. 592 (1989).

44. Vienna Convention, *supra* note 2, art. 6, para. 1, at 12, *reprinted in* 26 I.L.M. at 1531.

45. Montreal Protocol, *supra* note 3, art. 1, para. 2, *reprinted in* 26 I.L.M. at 1551. Article 1(2) is unaltered in the Protocol as amended. *London Amendments*, *supra* note 4, at 2.

46. Vienna Convention, *supra* note 2, art. 6, para. 1, at 15, *reprinted in* 26 I.L.M. at 1531; Montreal Protocol, *supra* note 3, art. 11, *reprinted in* 26 I.L.M. at 1557.

47. Montreal Protocol, *supra* note 3, art. 11, *reprinted in* 26 I.L. M. at 1557. Article 11 is not altered in this regard in the Protocol as amended. *London Amendments*, *supra* note 4, at 14.

Parties to the Convention, can vote on amendments to the Protocol.⁴⁸ Similarly, membership on the Executive Committee, which is responsible for the Multilateral Fund established by the London Amendments to the Protocol is limited to Parties to the Protocol as amended.⁴⁹

Although there are various groups of parties, there is only one Secretariat for the Convention and the Protocol. The Secretariat functions are carried out by the UNEP and, in this sense, the Vienna Convention can be seen as merely formalizing the coordinating role held by UNEP before the Vienna Conference.⁵⁰ The duties of the Secretariat are set forth both in the Convention and the Protocol, and both of these documents allow for the Conference of Parties to the Convention or the Parties to the Protocol to assign the Secretariat other functions.⁵¹

Finally, the organizational structure created by the Convention and Protocol necessarily has extensive relations with two other organizational clusters. First, in order to provide a better foundation for the timely making of policy, there are relations with the public international scientific community (namely, the World Meteorological Organization and the World Health Organization), leading national scientific agencies, and private international scientific organizations. Second, in order to provide financial and technical assistance, there are relations with organizations such as the World Bank.

B. The Lawmaking Process

A number of innovative steps in lawmaking are contained in the Montreal Protocol. The general implications of these steps are discussed in Part III; the following discussion describes the formal structure of the regime as it presently exists.

The Protocol anticipates that continued revision may be necessary, and calls for the Parties periodically to assess the adequacy of the measures taken in the Protocol.⁵² The Protocol provides that the parties, on

48. Vienna Convention, *supra* note 2, art. 9, paras. 2, 4, at 18-19, *reprinted in* 26 I.L.M. at 1532-33.

49. *London Amendments*, *supra* note 4, art. 10, at 12-13.

50. Vienna Convention, *supra* note 2, art. 7, para. 2, at 18, *reprinted in* 26 I.L.M. at 1532. UNEP's designation as the agency responsible for secretariat functions was only "on an interim basis." *Id.*

51. As to the duties assigned, see Vienna Convention, *supra* note 2, art. 7, at 17-18, *reprinted in* 26 I.L.M. at 1532; Montreal Protocol, *supra* note 3, art. 12, *reprinted in* 26 I.L.M. at 1558-59. Article 12 is unaltered in the Protocol as amended. *London Amendments*, *supra* note 4, at 14.

52. Montreal Protocol, *supra* note 3, art. 6, *reprinted in* 26 I.L.M. at 1556. Article 6 is basically unaltered in the Protocol as amended. *London Amendments*, *supra* note 4, at 10.

the basis of such an assessment, may decide to adjust the reductions called for in the controlled substances, and, if the parties are unable to reach agreement on such adjustments, two-thirds majority adoption of adjustments shall be binding upon all Parties to the Protocol.⁵³ Thus, the Parties to the Protocol have limited legislative power in this area with an objector's recourse being withdrawal generally from the Protocol. Some of the actions taken at the London Meeting were adjustments.

In contrast to this legislative-like adjustment process, there is also the more commonly encountered amendment process that becomes binding only upon those states who accept such amendments. In this regard, it is particularly important to see that although the parties may make adjustments to the controlled substances already designated, they cannot use an adjustment to designate a new controlled substance.⁵⁴ As a consequence, the actions taken at the London Meeting were in part also amendments. Many of the amendments relate to the creation of a financial mechanism, but many others relate to the addition of new controlled substances. The crucial implication, however, is that since amendments must be consented to in order to have application to any particular party, a confusing array of regimes may arise.⁵⁵

C. The Normative Scheme

1. The Obligation to Phase Out Designated Ozone-Depleting Chemicals

The basic regulatory approach of the Montreal Protocol in 1987 was to require the Parties to the Protocol to reduce their production and consumption of five chlorofluorocarbons specified in Group I to Annex A of the Protocol, and three halons specified in Group II to Annex A of the

53. Montreal Protocol, *supra* note 3, art. 2, para. 9, *reprinted in* 26 I.L.M. at 1553-54. In the Montreal Protocol, the two-thirds majority must also represent 50% of the total consumption of the controlled substances by the Parties. In the Protocol as amended, this requirement is changed to a two-thirds majority that reflects both a majority of those states whose special situation as developing states is recognized under the Protocol as amended, *London Amendments*, *supra* note 4, art. 5, para. 1, at 9, and a majority of those states that do not fit within this category. In this way, the Protocol better reflects not only the interests of those who presently consume CFCs, but also those who forgo developing such use.

54. As to the amendment process generally, see Vienna Convention, *supra* note 2, art. 9, at 18-19, *reprinted in* 26 I.L.M. at 1532-33. As to the characterization of designating new controlled substances as amendments, see Montreal Protocol, *supra* note 3, art. 2, para. 10, *reprinted in* 26 I.L.M. at 1554, as originally drafted and as clarified by the London amendments.

55. See *Report of the Second Meeting*, *supra* note 38, dec. II/16, at 18 (recommending that the Conference of Parties to the Vienna Convention undertake to consider how to expedite the amendment procedure for protocols).

Protocol. The London Adjustments to the Protocol accelerated this timetable and deepened the cuts by requiring the parties to phase out production and consumption entirely by the year 2000. The scheduled reductions required under both the Montreal Protocol and the London Adjustments for the Group I CFCs are represented in Figure 1, while the scheduled reductions required for halons are represented in Figure 2.

The London Amendments to the Protocol added new chemicals to the regulatory scheme, specifying them in a new Annex B. A phaseout by the year 2000 is required for other fully halogenated CFCs⁵⁶ and for carbon tetrachloride,⁵⁷ while a phaseout of methyl chloroform is required by the year 2005.⁵⁸ These scheduled phaseouts are represented in Figure 3.

As illustrated by Figures 1, 2, and 3, the scheduled reductions, leading ultimately to phaseouts, are expressed in terms of percentages of calculated national levels of consumption and production in either 1986, in the case of the substances originally regulated by the Protocol, or in 1989, for the substances added to the scope of the Protocol by the London Amendments. The national calculated levels thus are particularly important bench marks for the purpose of the regulatory scheme. It is important to note how the calculated level and the reductions in that level relate to baskets of substances. Group I of Annex A, for example, designates five different CFCs. It is up to each state to decide how they will mix reductions of the five so as to meet any particular scheduled reduction in the overall calculated level. To avoid false incentives in this scheme, the formula for the calculated level places all of the various designated chemicals on the same level by multiplying the amount of each chemical produced, imported, and exported by its "ozone-depleting potential," such potentials also being specified in the annex.⁵⁹

The use of national calculated levels is also significant because it inherently gives value to historical usage and avoids the difficult issue of equitably allocating between states a limited resource, the right to emit ozone-depleting substances. Thus, the United States could be viewed as particularly advantaged under the Montreal Protocol since a fifty percent reduction in its production and consumption would still leave it with a disproportionate per capita share of such use. This significance of course

56. *London Amendments*, *supra* note 4, art. 2C, at 4.

57. *Id.* art. 2D, at 4-5.

58. *Id.* art. 2E, at 5-6.

59. Montreal Protocol, *supra* note 3, art. 3, reprinted in 26 I.L.M. at 1554. Article 3 is basically unaltered in the Protocol as amended. *London Amendments*, *supra* note 4, at 6.

diminished greatly when the Protocol was adjusted and amended so as to require phaseouts rather than mere reductions.

Two constructive exceptions to the reductions schedule are expressed in terms of the calculated level. First, any party may transfer to another party any portion of its calculated level of production, so long as such transfers do not cause the parties involved to exceed collectively the production limit applicable to them as a group.⁶⁰ Second, if a party had contracted for a production facility prior to September 16, 1987, or provided for such expansion in national legislation prior to January 1, 1987, then that party may add such production to its calculated level.⁶¹

2. Recognition of the Special Situation of Developing Countries

The special situation of certain developing countries is recognized through the possibility of a delayed phaseout schedule for such countries. These special provisions apply to any party "that is a developing country and whose annual calculated level of consumption . . . is less than 0.3 kilograms per capita . . ."⁶² The delay works in two ways. First, these parties are allowed to exceed the target percentage reduction at any point in the schedule by a specified percentage of their initial calculated level if such action is necessary in order to satisfy "basic domestic needs."⁶³ Second, such developing countries, in order to meet basic domestic needs, also are entitled to delay at every point their compliance with the schedule of reductions leading to phase outs by a period of ten years.⁶⁴

60. *London Amendments*, *supra* note 4, art. 2, para. 5, at 2. The London Amendment to this paragraph greatly simplified and perhaps broadened somewhat what originally was termed "industrial rationalization." See *CFC Trading Under the Montreal Protocol: How Does it Work?*, GLOBAL ENVTL. CHANGE REP., Dec. 21, 1990, at 1.

61. *London Amendments*, *supra* note 4, art. 2, para. 6, at 3. The facility must have been completed by December 31, 1990, and such production must not raise the party's annual calculated level of consumption above 0.5 kilograms per capita. The London Amendment to this paragraph does not reflect any significant alteration in the original provision. This provision was intended to address central planning concerns of socialist states; it is unclear what practical significance it has, particularly after the changes that have occurred in what was the socialist world.

62. Montreal Protocol, *supra* note 3, art. 5, para. 1, *reprinted in* 26 I.L.M. at 1555. Article 5(1) is basically unaltered in the Protocol as amended. *London Amendments*, *supra* note 4, at 9.

63. Montreal Protocol, *supra* note 3, art. 2, *reprinted in* 26 I.L.M. at 1552-53. Article 2 in this regard is basically unaltered in its appearances in Articles 2, 2A-2E in the Protocol as amended. *London Amendments*, *supra* note 4, at 3-6.

64. Montreal Protocol, *supra* note 3, art. 5, *reprinted in* 26 I.L.M. at 1555. Article 5 in this regard is basically unaltered in the Protocol as amended. *London Amendments*, *supra* note 4, at 9.

3. The Resolution of States to Act Beyond the Requirements of the Protocol as Adjusted and Amended

It is important to recognize that the reduction schedule set forth in the Protocol as adjusted and amended represents only the baseline. A number of states have accepted greater obligations,⁶⁵ and the Protocol urges the parties to act with greater dispatch when possible. Particularly significant in this regard is the Declaration at the London Meeting by thirteen developed countries of "[t]heir firm determination . . . to phaseout the production and consumption of all fully halogenated chlorofluorocarbons controlled by the Montreal Protocol, as adjusted and amended, as soon as possible but no later than 1997."⁶⁶ Similarly, all the parties at the London Meeting resolved to do the following: refrain from using certain other halons except for essential applications; use "transitional substances with a low ozone-depleting potential, such as hydrochlorofluorocarbons (HCFCs)," with great care and with a view to their replacement by nonozone-depleting and more environmentally suitable alternatives no later than 2040 and, if possible, no later than 2020; phase out production and consumption of methylchloroform as soon as possible; and express appreciation to those parties that have already taken measures more stringent and broader in scope than those required by the Protocol.⁶⁷

D. Encouraging Participation and Facilitating Implementation

From the beginning, it was recognized that the shared nature of the ozone-depletion problem required widespread participation in the regime to be established by the Convention and Protocol. Encouragement of participation by developing countries, in particular India and China, required mechanisms to aid implementation of the regime by those countries. Thus, encouragement of participation and facilitation of implementation were and remain linked.

The regime encourages participation in a number of ways. First,

65. As to actions by the European Community, see *Council of Ministries Favors Regulation to Phase Out Chlorofluorocarbons by 1977*, 14 Int'l Env't Rep. (BNA) 3 (1991); *EC Environment Ministers Agree on CFC Phaseout, Vehicle Emission Cuts*, GLOBAL ENVTL. CHANGE REP., Jan. 4, 1991, at 3. As to actions by the Federal Republic of Germany, see *Strengthened German CFC Law Goes Before Parliament*, GLOBAL ENVTL. CHANGE REP., Jan. 18, 1991, at 3. As to actions by political subdivisions in the United States, see *State and Local CFC Laws on the Rise in US*, GLOBAL ENVTL. CHANGE REP., Dec. 21, 1990, at 4.

66. *Report of the Second Meeting*, *supra* note 38, paras. 48-49, at 20-21. The countries were Australia, Austria, Belgium, Canada, Denmark, the Federal Republic of Germany, Finland, Liechtenstein, the Netherlands, New Zealand, Norway, Sweden, and Switzerland.

67. *Id.* Annex VII.

because the reduction schedules are tied to either 1986 or 1989 levels of consumption and production, there is no advantage to waiting to join the regime. Second, although the parties to the regime during the phaseout periods may trade the controlled substances with one another, the Protocol, as adjusted and amended, progressively restricts trade involving controlled substances between parties and nonparties.⁶⁸ Thus, for example, by January 1, 1993, the parties, having agreed upon a list of products containing the controlled substances specified in the Montreal Protocol,⁶⁹ shall bar the import of those products from any state not party to the Protocol.⁷⁰

Third, the Protocol not only attempts to limit the advantages of remaining outside, but for developing countries, also provides incentives to join. The Montreal Protocol originally was vague on this point, providing that the parties, recognizing the particular needs of developing countries, "shall . . . cooperate in promoting technical assistance to facilitate participation in and implementation of this Protocol."⁷¹ In response to the positions of India and China in particular, more specific and detailed provisions for financial assistance and technology transfer were adopted at the London Meeting.⁷²

E. Noncompliance, Enforcement, and Dispute Settlement

Thus far, the Parties to the Convention and the Protocol have been concerned primarily with elaboration of and formal participation in the regime. As a result, enforcement procedures at this point are not particularly developed.

The key monitoring and enforcement device at present is the requirement for parties to provide to the Secretariat statistics on production, on imports and exports to parties and nonparties, and on amounts destroyed or recycled as feedstocks.⁷³ Such reports will aid Secretariat

68. See generally *London Amendments*, *supra* note 4, art. 4, at 7-9.

69. See Vienna Convention, *supra* note 2, art. 10, at 19-20, *reprinted* in 26 I.L.M. at 1533 (procedures elaborating this list).

70. *London Amendments*, *supra* note 4, art. 4, para. 3, at 8. The London Amendments to article 4 primarily attempt to adapt that article to the addition of the new Annex B.

71. Montreal Protocol, *supra* note 3, art. 10, *reprinted* in 26 I.L.M. at 1557.

72. See generally *London Amendments*, *supra* note 4, arts. 10, 10A, at 12-14. Under Decision II/8A taken at the London Meeting, an "Interim Financial Mechanism" of quite similar design was established for the period January 1, 1991, to December 31, 1993, or "until such time as the Financial Mechanism is established." *Report of the Second Meeting*, *supra* note 38, dec. II/8 A, at 12. See generally Handl, *supra* note 25; Rosencranz & Milligan, *supra* note 25.

73. *London Amendments*, *supra* note 4, art. 7, at 10-11. The amendment to Article 7 expanded upon the original reporting requirement by recognizing the need also to follow amounts destroyed or recycled as feedstocks.

and party monitoring, and will also further nongovernmental organization involvement since such data is not regarded as confidential.⁷⁴ Unfortunately, not all parties have made such reports, or have submitted incomplete reports. The London meeting of the parties, noting these reporting difficulties, established an ad hoc group of experts to consider the reasons for the difficulties and to recommend solutions.⁷⁵

Investigatory and dispute settlement provisions are quite limited. The Convention, with application to the Protocol,⁷⁶ provides that in the event of a dispute concerning interpretation or application of a provision, the parties (1) shall negotiate; (2) failing that, seek the good offices of, or request mediation by, a third party; and (3) failing that, submit the dispute to conciliation.⁷⁷ The parties, in accepting the Convention also may declare that they accept as a means of dispute settlement either arbitration or submission to the International Court of Justice, or both.⁷⁸ Against that backdrop, the Parties to the Protocol have been considering procedures and institutional mechanisms for determining noncompliance and for treatment of parties found to be in noncompliance.⁷⁹ Interim noncompliance provisions adopted at the London Meeting essentially provide for parties with reservations regarding implementation by other parties to report such concerns in writing to the Secretariat. The Secretariat shall transmit the submission to an Implementation Committee established by these same interim procedures, and that Committee shall consider the record with a view to securing an amicable resolution.⁸⁰ The Committee shall report on its work to the Meeting of the Parties and the parties "may . . . decide upon and call for steps to bring about full compliance . . . including measures to assist the Party's compliance"⁸¹

IV. THE EVOLVING STRUCTURE OF INTERNATIONAL ENVIRONMENTAL LAWMAKING

Reflection on the international effort to protect the stratospheric

74. *Report of the Second Meeting*, *supra* note 38, dec. II/9, at 12.

75. *Id.*

76. Montreal Protocol, *supra* note 3, art. 14, *reprinted in* 26 I.L.M. at 1559. Article 14 is unaltered in the Protocol as amended. *London Amendments*, *supra* note 4, at 14.

77. Vienna Convention, *supra* note 2, art. 11, at 20-21, *reprinted in* 26 I.L.M. at 1533-34.

78. *Id.* art. 11, para. 3, at 21, *reprinted in* 26 I.L.M. at 1534. At the time of the Vienna Convention, 16 countries expressed their regret at the absence of a compulsory provision for the settlement of disputes. *See id.* at 35, *reprinted in* 26 I.L.M. at 1535.

79. *See* Montreal Protocol, *supra* note 3, art. 8, *reprinted in* 26 I.L.M. at 1556.

80. *Report of the Second Meeting*, *supra* note 38, dec. II/5, at 12; *see also id.* Annex III.

81. *Id.* Annex III.

ozone layer illuminates the emerging structure of international environmental lawmaking. International environmental lawmaking is different from international lawmaking in general in at least three respects. First, environmental lawmaking must be conducted amidst great uncertainty about the reality, cause, and extent of the problem. Second, because the nature of environmental problems such as ozone depletion requires concerted action, it is necessary that at least the major contributors to the problem, present and future, be parties to the regime. Third, because it is difficult to separate environmental problems from one another and from development concerns generally, environmental lawmaking runs the risk of either being unmanageable or not system-oriented. This section discusses each of these differences in turn.

A. Lawmaking Amidst Uncertainty: The Process as the Solution

We ordinarily might expect that states seeking to address an international problem would work towards a diplomatic conference where a treaty addressing an issue could be negotiated. Without in any way implying that this "ordinary" situation is easy, the international environmental context can be far more difficult because the views of the parties as to the nature of the environmental problem not only can be quite different, but moreover, the knowledge of all environmental problems is likely incomplete even though evolving. In the "ordinary" context a central task in the lawmaking effort is to improve communication between the parties so that they may better understand each other's objectives and concerns. In negotiations concerning environmental matters, however, there is the added and quite different task of the parties seeking to discover precisely what the environment requires. In this sense, the environment is an unobtrusive, but central presence in the negotiations. It is a party that does not volunteer information, but may answer questions if asked correctly. It is also a party that refuses to negotiate.

In the case of stratospheric ozone depletion, the international community initially confronted great debate as to whether there was a problem at all, followed by debate regarding the extent of the problem. As observed by many scholars in the past several decades, the nature of many environmental problems requires action by the relevant community before it has proof of the theory. In other words, the international community, despite uncertainty about the theory, must act to confront the danger indicated by the theory. Moreover, it must act knowing that its knowledge will continue to evolve and suggest further actions. These aspects of uncertainty and evolving knowledge lead to two major differences in international environmental lawmaking efforts from lawmaking

efforts generally. Both of these differences evidence an emphasis on an ongoing process of lawmaking rather than, as ordinarily the case, the one time negotiation of a treaty at a particular conference.

The first difference is the explicit incorporation of scientific inquiry into the lawmaking process. Dealing with the uncertainty necessarily present in environmental problems requires that the process not only increase the shared knowledge of the parties, but that such knowledge also accurately reflect the state of scientific understanding of the problem. This requires much greater cooperation between the lawmaking community attempting to draft a response and the scientific community seeking to understand the phenomena. Imbedding this scientific effort in an international organizational structure or in international efforts that coordinate national efforts increases the perceived legitimacy, and hence shared nature, of the resulting description of the problem. Making the scientific inquiry an integral part of an ongoing lawmaking process serves both to educate the lawmakers and to speed up the incorporation of such knowledge into the process. In the case of the ozone regime, the Protocol institutionalizes this cooperation by requiring the convening of "appropriate panels of experts" (scientific, environmental, technical, and economic) at least one year before the parties meet to reassess the sufficiency of the Protocol's controls on ozone-depleting substances.⁸²

The second major difference is that the lawmaking effort that accommodates evolving knowledge through the establishment of an ongoing process of lawmaking continuously incorporates new knowledge and revises previous responses. In this sense, the Protocol calls for the parties to periodically "assess the control measures provided for in Article 2 on the basis of available scientific, environmental, technical, and economic information."⁸³ Thus, we see a transition from a one-conference effort to an ongoing process, and from "two steps behind" to action on the basis of evolving knowledge. In this sense, cooperation and education are recognized as important aspects of the lawmaking process in the environmental area. For all these reasons, the solution to a threat such as ozone depletion is not the particular requirements of the Montreal Protocol or the London Adjustments and Amendments to the Protocol. Rather, the solution is the process which yielded the Protocol and which already looks ahead to the next adjustments and amendments.

82. Montreal Protocol, *supra* note 3, art. 6, reprinted in 26 I.L.M. at 1556. Article 6 is basically unaltered in the Protocol as amended. *London Amendments*, *supra* note 4, art. 6, at 10.

83. Montreal Protocol, *supra* note 3, art. 6, reprinted in 26 I.L.M. at 1556.

B. Consensual Lawmaking on Transcendent Problems

International environmental lawmaking is also distinct in that the nature of many environmental problems requires that at least those countries primarily contributing, or potentially contributing, to the problem participate in the regime. The environmental regime is dictated by the planet in the sense that the earth is not willing to negotiate the terms of a solution. In the previous section, it was asserted that states must negotiate a regime despite the fact that they are uncertain as to what precisely the earth requires. This section points to the need to encourage participation in global environmental regimes by at least those states which are, or potentially are, significant contributors to the problem.

In encouraging participation, the tools of the lawmaker are sticks and carrots. In other words, states either may be penalized for not joining the regime or rewarded for doing so. In the ozone protection regime, developing countries were encouraged to join through the recognition of their special needs. Moreover, although there are no sticks per se, the treaty does attempt to prevent those who remain outside from benefitting by doing so. First, there is no advantage in waiting to join the treaty since the baseline calculation from which reductions are to be made is fixed. Second, there is no trade advantage in remaining outside the convention since it restricts members from trading in areas involving the regulated substances with those outside the regime.

The more subtle implication of needing widespread participation, as discussed above, was the demand by China, India, and others for a linkage between their agreement to participate in the regime and satisfaction of other concerns, particularly, development assistance for the Third World. In the case of stratospheric ozone protection, linkage ultimately was made in the London amendments. The amendments provide for technology transfer and establish a fund to aid implementation of the Protocol by facilitating nonozone-depleting paths for growth in developing countries. The scale of linkage in the greenhouse gas negotiations will be an order of greater magnitude. The lawmaking risk presented by issue linkage is that it likely causes the scope of the agreement to increase. Moreover, the agreement, as a result, may embody compromises on linked issues and thus have the flavor of a package deal. This line of reasoning raises for some observers the possibility that greenhouse negotiations will bog down as did the Law of the Sea negotiations, and like the Law of the Sea, will result ultimately in an agreement that is too rigid because of the delicate balancing that is required. However, the sense of urgency which is associated with climate change did not exist with the

Law of the Sea issue. In this sense, the urgency of climate change likely will push negotiations along despite the recognition of the special needs of developing countries. Other possibly even broader linkages to North-South questions, however, are perhaps best avoided so as to keep manageable the already broad scope of negotiations.

C. The Tension Between Manageability of Negotiations and Systemic Thinking

One of the first lessons of environmental studies is the need to approach the environment as a system, an indivisible process. The lawmaker, however, can not approach the development of an environmentally sound relationship between humanity and the world all at once. Rather, negotiations must be limited so that the number of issues and interests involved remain at a manageable level. The danger with the slicing off of what appears to be a somewhat separable and manageable problem, however, is that systemic thinking may be lost. The question thus becomes how to best reconcile the need for manageable negotiations with the need for holistic thinking.

In the case of ozone depletion, the negotiations, at least initially, in moving to address the depletion problem did not consider whether their solutions might rest upon assumptions that would exacerbate the greenhouse gas problem. In particular, the reductions in CFC and halon use agreed to in Montreal were premised in part on the belief that ozone-safe substitutes existed. But, as already mentioned, not only did it later turn out that these substances also were ozone depleting, they also came to be seen as highly efficient greenhouse gases.

In this regard, I suggest that the regime negotiators take care to identify the major scientific, technical, environmental, and economic assumptions underlying major policy choices so that the corresponding panels of experts in these areas, already an integral part of the process, might examine such assumptions against their more general knowledge, and hence, in a more systemic fashion.

V. CONCLUSION

In the little over fifteen years since the theory of ozone depletion was put forward, the international community moved relatively quickly to order the phaseout of key ozone-depleting substances by the year 2000. In doing so, the community formed an international regime, despite uncertainty, in relation to a problem whose solution requires near universal participation. Scholarly elaboration of the lessons of that effort is needed

so that the more difficult upcoming negotiations regarding greenhouse gases may be fruitful. Among others things, an international environmental lawmaking process should:

- (1) address uncertainty and the evolving nature of one's knowledge by explicitly viewing such lawmaking as an ongoing process within which knowledge is advanced and becomes shared through the imbedding of scientific, technical, environmental, and economic expertise in the organizational regime;
- (2) encourage participation, yet avoid unrelated linkages, by addressing related interests of special groups of states and by denying any benefit to those remaining outside the regime; and
- (3) resolve the tension of manageability of negotiations and systemic thinking by the identification of factual assumptions underlying major policy directions and by placing such assumptions also within the scope of inquiry of the expert's committees imbedded in the process.

Finally, I stress that even as the international lawmaking process develops, we must remember that another whole phase, that of international and national implementation of this international normative construct, remains to be addressed.

FIGURE 1

Figure 1
Regulation of Annex A Group I CFCs Under
the Montreal Protocol and London Adjustments

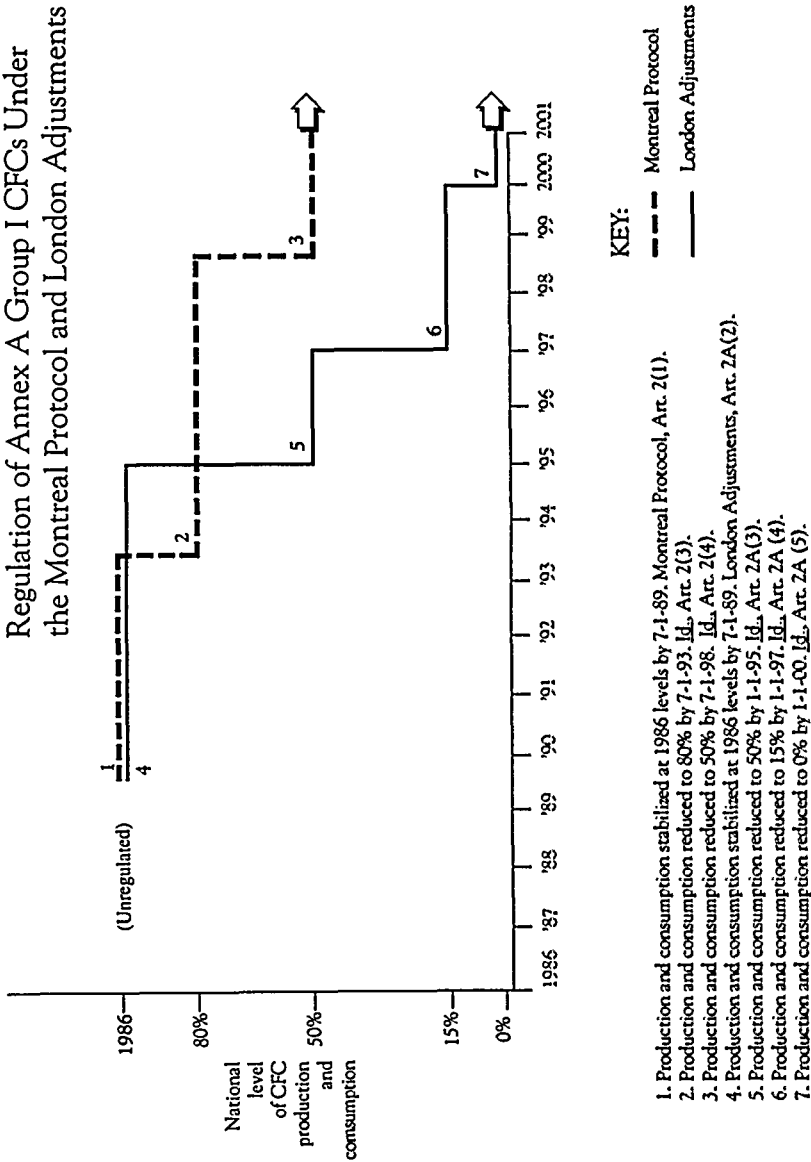


FIGURE 2

Figure 2
Regulation of Annex A Group II Halons Under the
Montreal Protocol and London Adjustments

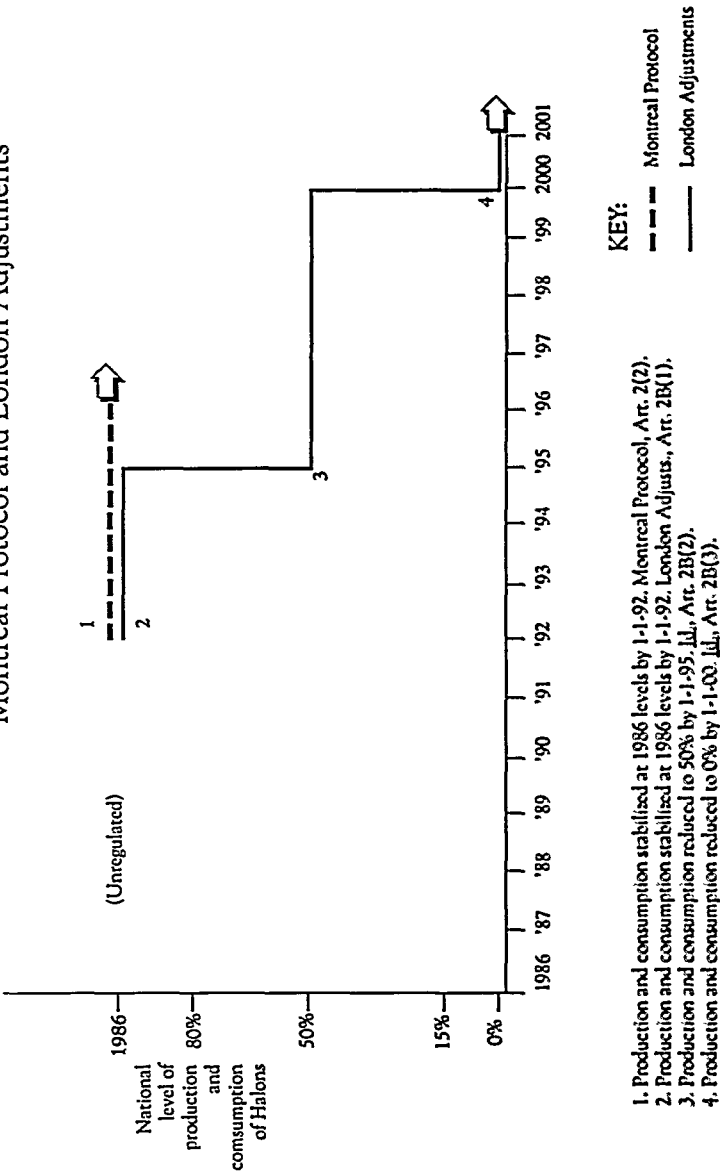


FIGURE 3

Figure 3
Regulation of Annex B Substances Under
the London Amendments to the Montreal Protocol

