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GLOBAL WARMING AND THE WASHINGTON CONFERENCE: RECOMMENDATIONS FOR AN INTERNATIONAL AGREEMENT TO COMBAT GLOBAL WARMING

Jeffrey T. Lindgren*

INTRODUCTION

Global warming is presently one of the preeminent environmental issues facing the world. Many scholars claim that global warming will have "ultimate consequences . . . second only to global nuclear war."¹ Skeptics, however, claim that the global warming theory lacks a sufficient scientific basis.² The lack of scientific certainty creates difficulty in international negotiations aimed at combatting the causes of global warming. The severity of the potential consequences, however, requires immediate action to arrest the threat to the global community.

Global warming, or the greenhouse effect, has two components: an increase of certain greenhouse gases, such as carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄), tropospheric ozone (O₃), and

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1. *The Changing Atmosphere: Implications for Global Security* (July 5, 1988), statement from conference held in Toronto, Canada on June 27-30, 1988, reprinted in *Selected Legal Materials*, 5 AM. U.J. INT'L L. & POL'Y 515, para. 1 (1990) [hereinafter *Toronto Conference Statement*].

2. Kriz, *Ozone and Evidence*, Nat'l J., Nov. 11, 1989, at 45. In the Bush Administration, White House chief of staff John H. Sununu and White House science advisor D. Allan Bromley feel that the scientific evidence of the greenhouse effect is unconvincing and carbon dioxide (CO₂) controls are unnecessary and too costly at this time. *Id.* See generally Stevens, *With Cloudy Crystal Balls, Scientists Race to Assess Global Warming*, N.Y. Times, Feb. 7, 1989, at C1 (discussing how the computer models used to estimate the effects of global warming fail to take into account important factors, thereby limiting their accuracy); Shabecoff, *Global Warmth In '88 Is Found To Set a Record*, N.Y. Times, Feb. 4, 1989, at A1 (citing the temperature data of 1988); Shabecoff, *U.S. Data Since 1895 Fail To Show Warming Trend*, N.Y. Times, Jan. 26, 1989, at A1 (reviewing a NOAA report which concludes that climate data from 1895 fails to support global warming); Browne, *Was That a Greenhouse Effect? It Depends on Your Theory*, N.Y. Times, Sept. 4, 1988, § 4, at 1 (discussing the conflicting conclusions about the greenhouse effect); Bluestone, Smith & Yanchinski, *The Global Greenhouse Finally Has Leaders Sweating*, Bus. Wk., Aug. 1, 1988, at 74 (observing the recognition of global warming by world leaders); Shabecoff, *Temperature For World Rises Sharply In The 1980's*, N.Y. Times, Mar. 29, 1988, at C4 (analyzing the climate data of the 1980's).

chlorofluorocarbons (CFCs) in the atmosphere;³ and the absorption and long wave heat radiation attributed to these gases.⁴ The second component causes the global temperature to rise.⁵ Temperature increase has a number of adverse environmental consequences such as sea level rise,⁶ changing weather and precipitation patterns,⁷ and loss of plant and animal species.⁸ CO₂ is the most significant gas because it is conveyed directly and indirectly through the generation of electricity using fossil fuels, which include gas, oil, and coal.⁹

International environmental law principles are insufficient to deal with global warming.¹⁰ The *Trail Smelter Arbitration* establishes an important principle of international environmental law that is applicable to global warming.¹¹ This international action involving transboundary air pollution resolved that states may not use their territory in a manner which injures another state.¹² The facts of the case, specif-

3. B. BOLIN, B. DOOS, J. JAGER & R. WARRICK, *THE GREENHOUSE EFFECT, CLIMATIC CHANGE, AND ECOSYSTEMS 1-2* (1986) [hereinafter *GREENHOUSE EFFECT*].

4. *Id.*

5. Zaelke & Cameron, *Global Warming and Climate Change — An Overview of the International Legal Process*, 5 AM. U.J. INT'L L. & POL'Y 249, 253 (1990). Whether the greenhouse effect will cause global temperatures to rise is subject to considerable debate because many experts come to conflicting conclusions. See e.g. Shabecoff, *Global Warming: Experts Ponder Bewildering Feedback Effects*, N.Y. Times, Jan. 17, 1989, at C1 (discussing the theories which conclude the greenhouse effect may cause cooling, not warming).

6. Zaelke & Cameron, *supra* note 5, at 255.

7. Solomon & Freedberg, *The Greenhouse Effect: A Legal and Policy Analysis*, 20 ENVTL. L. 83, 84 (1990). Experts disagree about the types of changes likely to occur in weather and precipitation patterns due to the greenhouse effect. Shabecoff, *supra* note 5, at C1.

8. Solomon & Freedberg, *supra* note 7, at 94.

9. *GREENHOUSE EFFECT*, *supra* note 3, at 8. Fossil fuels provide roughly 80% of world wide energy consumption and 90% of the energy needs for the United States. Wald, *Fighting the Greenhouse Effect*, N.Y. Times, Aug. 28, 1988, § 3, at 1.

10. Pallemmaerts, *International Legal Aspects of Long-Range Transboundary Air Pollution*, 1988 HAGUE Y.B. INT'L L. 189, 205.

11. *Trail Smelter* (U.S. v. Can.), 3 R. Int'l Arb. Awards 1907 (1941) *reprinted in* 35 AM. J. INT'L L. 684 (1941). The United States claimed that pollution from a Canadian smelter caused damage to property in the state of Washington. *Id.* An arbitration tribunal was created and subsequently determined that Canada was liable for the past damage. *Id.* The tribunal had made the damages determination in a prior interim decision. 33 AM. J. INT'L L. 182 (1939).

12. *Trail Smelter*, 3 R. Int'l Arb. Awards at 1965 *reprinted in* 35 AM. J. INT'L L. at 716. The tribunal specifically stated:

No state has the right to use or permit the use of territory in such a manner as to cause injury by fumes or to the territory of another, of the properties of persons therein, when the case is of serious consequence and the injury is established by clear and convincing evidence.

Id. This decision is sometimes characterized as *obiter dictum* because Canada had previously accepted liability for past damage done by the smelter. Pallemmaerts, *supra* note 10, at 205.

ically the liability determination, however, fail to make the rule universally applicable.¹³

The 1972 United Nations Conference on the Human Environment adopted Principle 21 of the Stockholm Declaration reiterating the principle used to decide *Trail Smelter*.¹⁴ Principle 21 recognizes that states have the right to use their resources as they wish and the responsibility to ensure that their activities do not injure other states.¹⁵ Together, *Trail Smelter* and Principle 21 establish a fundamental precept of international environmental law.¹⁶ This principle, however, is not easily applicable to problems of atmospheric pollution because of the difficulty in tracing this type of pollution to a specific source.¹⁷ This inabil-

13. Pallemerts, *supra* note 10, at 205. The damage caused in *Trail Smelter* was directly traceable to the Canadian smelter. *Id.* The principle is inapplicable to acid rain and the release of compounds that destroy the ozone layer because of the difficulty in tracing the damage back to a specific source. *Id.* See *infra* note 17 (discussing the causes of acid rain and ozone layer depletion).

14. *Stockholm Declaration on the Human Environment, in Report of the United Nations Conference on the Human Environment*, U.N. Doc. A/CONF. 48/14 and Corr. 1 (1972), U.N. Sales No. E. 73. II. A.14 and Corr., reprinted in 11 I.L.M. 1416 (1972) [hereinafter *Stockholm Declaration*].

15. *Id.* at 1420. Principle 21 provides that:

States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction.

Id.

The first clause does not detract from the duty not to cause damage in other states. Pallemerts, *supra* note 10, at 206. Although not legally binding, this statement confirms the existing rule of customary international law on transfrontier pollution enunciated in *Trail Smelter*. *Id.*

16. See P. SANDS, *CHEMNOBYL, LAW AND COMMUNICATION: TRANSBOUNDARY NUCLEAR AIR POLLUTION — THE LEGAL MATERIALS* 1, 15 (P. Sands ed. 1988) (stating that both *Trail Smelter* and Principle 21 establish a rule of customary international law).

17. J. BRUNNEE, *ACID RAIN AND OZONE LAYER DEPLETION: INTERNATIONAL LAW AND REGULATION* 13 (1988). Gaseous SO₂ or NO_x emissions enter the atmosphere and oxidize into sulphate or nitrate particles forming acid rain. *Id.* at 10-13. The particles then transform into sulfuric or nitric acid in the presence of water vapor. *Id.* at 13. Once in this form the pollutants may be transported thousands of miles from their source of emission, depending on meteorological forces, before being released into the environment in the form of rain, snow, or fog. *Id.* at 8. This process makes it difficult to determine the source when many industrial nations are located within the region, as is the case of Europe, and bilateral agreements are insufficient to resolve the problem. *Id.*

Bilateral negotiations will not resolve ozone layer depletion for the same reasons that they will not resolve acid rain problems. *Id.* at 35. The release of chlorofluorocarbons (CFCs) into the atmosphere causes a chemical reaction in which chlorine destroys the ozone layer. *Id.* at 38-39. Most ozone depleting compounds are released from sites in industrialized nations and the effects are uneven. *Id.* Ozone depletion has been identified in areas of the northern hemisphere and above Antarctica, but the loss of the ozone

ity to identify specific sources led to international agreements on trans-boundary air pollution and ozone layer depletion.¹⁸

An international conference, which began meeting in Washington in February, 1991, and periodically over the following eighteen months, will attempt to forge an agreement to control the emissions of greenhouse gases.¹⁹ Over twenty industrialized nations have committed themselves to stabilizing or reducing CO₂ emissions, the gas which plays the largest role in global warming.²⁰ The challenge for the conference delegates is to bring as many nations as possible into the agreement and to develop a framework for actual reductions tied to environmental needs. Analysis of existing atmospheric environmental agreements reveals how a global warming agreement should be constructed.

This Comment will examine how existing agreements on the atmospheric environment should affect negotiations on global warming. Part I analyzes international agreements which cover long-range trans-boundary air pollution. Part II analyzes the international agreements protecting the ozone layer. Part III examines the United States Clean Air Act Amendments of 1990 (Clean Air Act Amendment) which govern long-range air pollution, ozone layer protection, and the reduction of certain greenhouse gases. Part IV proposes recommendations for global warming negotiations; the proposals are not specifically tied to the global warming conference.

I. INTERNATIONAL AGREEMENTS ON LONG-RANGE AIR POLLUTION

Evidence linking environmental damage to certain air pollutants transported through rainfall sparked the international movement to

layer affects the global community. Wexler, *Protecting the Global Atmosphere: Beyond the Montreal Protocol*, 14 MD. J. INT'L L. & TRADE 1, 3 (1990).

18. See Note, *The Convention on Long-Range Transboundary Air Pollution: Meeting the Challenge of International Cooperation*, 30 HARV. INT'L L.J. 447, 452-55 (1989) (discussing the events precipitating international agreements). Regional agreements are not sufficient to adequately address the problem of acid deposition because pollutants may travel thousands of miles from their source and their effects are global. J. BRUNNEE, *supra* note 17, at 8; see *supra*, note 10 (explaining the inadequacy of regional agreements).

19. Weisskopf, *U.S. Gets Mixed Reviews on Global Warming Plan*, Wash. Post, Feb. 5, 1991, at A3 (noting that more than 130 nations are participating in the conference). *Id.*

20. Stevens, *Hopeful E.P.A. Report Fans a Debate as Talks on Warming Near*, N.Y. Times, Jan. 13, 1991, § 1, at 18.

control and reduce acid rain.²¹ The inability of unilateral or bilateral measures to deal with the problem became apparent when coordinated monitoring studies in Europe demonstrated that emissions from sources in foreign nations caused the majority of acid rain.²² The Convention on Long-Range Transboundary Air Pollution (Geneva Convention) and its protocols grew out of the need for an international response to the problems of acid rain.²³

A. CONVENTION ON LONG-RANGE TRANSBOUNDARY AIR POLLUTION

In November, 1979, thirty-four countries adopted the Geneva Convention²⁴ at a High Level Meeting on the Protection of the Environment in Geneva.²⁵ The Geneva Convention actually entered into force in March, 1983 and is the first multilateral treaty designed to protect the atmospheric environment.²⁶ The Geneva Convention contains

21. Note, *supra* note 18, at 452-53. Sweden presented the first evidence linking environmental damage to transboundary air pollution at the 1972 Stockholm Conference on the Environment. *Id.* The report presented at the conference is entitled: *Sweden's Case Study for the United Nations Conference on the Human Environment, 1972: Air Pollution Across National Boundaries. The Impact on the Environment of Sulphur in Air and Precipitation. Id.*

22. Note, *supra* note 18, at 454.

23. *Id.* at 454-55.

24. Convention on Long-Range Transboundary Air Pollution, *opened for signature* Nov. 13, 1979, T.I.A.S. No. 10541 (*entered into force* March, 1983), *reprinted in* 18 I.L.M. 1442 (1979) [hereinafter Geneva Convention].

25. United Nations: Protocols to the 1979 Convention on Long-Range Transboundary Air Pollution, *reprinted in* 27 I.L.M. 698, 698 (1988) [hereinafter U.N. Protocols]. There are 35 signatories to the Geneva Convention: 34 countries and the European Economic Community (E.E.C.). *Id.* Only 31 countries and the E.E.C. have ratified the agreement and are considered parties. *Id.* The 31 countries are: Austria, Belgium, Bulgaria, Byelorussia S.S.R., Canada, Czechoslovakia, Denmark, Finland, France, German Democratic Republic, Federal Republic of Germany, Greece, Hungary, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, The Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, Ukrainian S.S.R., Union of Soviet Socialist Republics (U.S.S.R.), United Kingdom (U.K.), United States (U.S.), and Yugoslavia. *Id.*

26. Note, *supra* note 18, at 456. *See generally* Cameron, *International Cooperation and Acid Rain Pollution: Establishing the Framework for Control*, 18 INT'L J. ENVTL. STUD. 129 (1982) (examining the Geneva Convention and other forms of international cooperation in controlling acid rain); Rosencranz, *The ECE Convention of 1979 on Long-Range Transboundary Air Pollution*, 75 AM. J. INT'L L. 975 (1981) (reviewing the Geneva Convention as a framework for controlling transfrontier air pollution); Tollan, *The Convention on Long-Range Transboundary Air Pollution*, 19 J. WORLD TRADE L. 615 (1985) (analyzing the Geneva Convention as a means of controlling transfrontier air pollution); Wetstone & Rosencranz, *Transboundary Air Pollution: The Search for an International Response*, 8 HARV. ENVTL. L. REV. 89 (1984) (stating that international organizations are the most effective means of combatting transfrontier air pollution).

neither pollution reduction measures nor a time frame in which reductions must be achieved.²⁷ It simply establishes a mechanism to negotiate and implement pollution reduction measures.²⁸

The Geneva Convention contains a few substantive provisions subject to numerous qualifications which diminish their effect.²⁹ For example, the two most important provisions, articles 2 and 6, which define the basic obligations of the agreement in terms of air pollution control policy, are limited in scope.³⁰ Article 2 explicitly states that the parties "are determined to protect man and his environment against air pollution."³¹ Article 2 is more of a recommendation rather than a legal obligation, because it is subject to two qualifications which do not prohibit further increases in emissions.³²

Article 6 compels the parties to develop the best policies and strategies to fight air pollution.³³ The application of this article is restricted because it contains escape clauses which restrict its scope.³⁴ Article 5

27. Note, *supra* note 18, at 456.

28. *Id.*

29. Pallemmaerts, *supra* note 10, at 191-92.

30. Geneva Convention, *supra* note 24, at art. 2, 6.

31. Geneva Convention, *supra* note 24, at art. 2. The article states that "[t]he Contracting Parties, taking due account of the facts and problems involved, are determined to protect man and his environment against air pollution and shall endeavor to limit and, as far as possible, gradually reduce and prevent air pollution including long-range transboundary air pollution." *Id.*

32. *Id.* The two qualifications reduce the scope of the provision. *Id.* First, the fundamental principle is subject to "the facts and problems involved." *Id.* This qualification enables states to change the applicability of this article depending on the facts of the situation. Pallemmaerts, *supra* note 10, at 191.

Second, the parties merely agree to "endeavor to limit and, as far as possible, gradually reduce and prevent air pollution." Geneva Convention, *supra* note 24, at art. 2. The use of the word "endeavor," rather than a word such as undertake or require, leaves the decision to act to the discretion of the party. Pallemmaerts, *supra* note 10, at 191.

33. Geneva Convention, *supra* note 24, at art. 6. The article reads, in pertinent part:

[I]n order to combat air pollution, in particular that originating from new or rebuilt installations, each Contracting Party undertakes to develop the best policies and strategies including air quality management systems and, as part of them, control measures compatible with balanced development, in particular by using the best available technology which is economically feasible and low-waste and non-waste technology.

Id.

34. Pallemmaerts, *supra* note 10, at 192. This provision targets "new or rebuilt installations," in contrast to older installations which tend to emit more pollution, thus limiting its scope. Geneva Convention, *supra* note 24, at art. 6.

There are also "compatibility with balanced development" and "economic feasibility" qualifications. *Id.* These qualifications leave the application of control technology to the discretion of the parties. Pallemmaerts, *supra* note 10, at 192. During the negotiations, the parties were concerned with binding themselves to pollution reduction procedures which would hamper their industrial development or growth plans. *Id.*

contains a surprisingly broad obligation to consult.³⁵ This provision provides that the interests of a concerned neighboring state be heard and considered early in the planning stage of a project contemplated pursuant to this Convention.³⁶

The Geneva Convention also recognizes the importance of the exchange of technological research and scientific information to help identify causes and potential remedies for acid deposition.³⁷ This agreement, however, does not provide any pollution reduction measures or time frames in which to reduce pollution.³⁸ The Convention's primary contribution is that it is the first multilateral agreement devoted to protecting the global atmospheric environment from long-range transboundary air pollution.³⁹

B. PROTOCOL ON LONG-TERM FINANCING OF EMEP

The first protocol to the Geneva Convention, The Protocol on Long-Term Financing of the Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe (EMEP Protocol), was adopted in September 1984.⁴⁰ The EMEP Protocol simply establishes permanent funding for the EMEP region-

35. Geneva Convention, *supra* note 24, at art. 5. The article reads:

Consultations shall be held, upon request, at an early stage between, on the one hand, Contracting Parties which are actually affected by or exposed to a significant risk of long-range transboundary air pollution and, on the other hand, Contracting Parties within which and subject to whose jurisdiction a significant contribution to long-range transboundary air pollution originates, or could originate, in connection with activities carried on or contemplated therein.

Id.

36. J. BRUNNEE, *supra* note 17, at 178.

37. Note, *supra* note 18, at 456.

38. *Id.*

39. *Id.*

40. Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Long-Term Financing of the Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe (EMEP), *adopted and opened for signature* Sept. 28, 1984, *reprinted in* 27 I.L.M. 698, 701 (1988) [hereinafter EMEP Protocol]. This protocol was ratified by: Austria, Belgium, Bulgaria, Byelorussia S.S.R., Canada, Czechoslovakia, Denmark, Finland, France, German Democratic Republic, Federal Republic of Germany, Hungary, Ireland, Liechtenstein, Luxembourg, The Netherlands, Norway, Spain, Sweden, Switzerland, Turkey, Ukrainian S.S.R., U.S.S.R., U.K., United States, Yugoslavia, and the E.E.C. *Id.* at 698. Canada and the United States are not subject to the mandatory contribution requirement because the EMEP Protocol only covers Europe; however, they may make voluntary contributions. EMEP Protocol, *supra* note 40, at arts. 3-4. Ratification by three additional countries is necessary for the EMEP Protocol to enter into force. EMEP Protocol, *supra* note 40, at art. 10.

wide pollution monitoring program⁴¹ and, therefore, is not the subject of this analysis. This protocol covers only Europe and requires all parties to make mandatory contributions to EMEP at levels specified within the agreement.⁴² Nonetheless, the EMEP Protocol is significant because it is the first agreement to require mandatory contributions to fund the monitoring of long-range transboundary air pollution.⁴³

C. PROTOCOL ON THE REDUCTION OF SULPHUR DIOXIDE EMISSIONS OR THEIR TRANSBOUNDARY FLUXES BY AT LEAST THIRTY PERCENT

In July, 1985, the Protocol to the 1979 Convention on Long-Range Transboundary Pollution on the Reduction of Sulphur Emissions or Their Transboundary Fluxes by at Least 30 Per Cent (SO₂ Protocol) was adopted in Helsinki.⁴⁴ It entered into force in September, 1987.⁴⁵ This protocol imposes legal obligations to reduce and limit long-range transboundary air pollution.⁴⁶ Sulphur emissions are a source of air pollution that contribute to acidification-related damage in North America and Europe.⁴⁷

The SO₂ Protocol requires thirty percent reductions in sulfur dioxide (SO₂) emissions or their transboundary fluxes by 1993.⁴⁸ The SO₂ Pro-

41. EMEP Protocol, *supra* note 40, art. 2. EMEP refers to the Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe. Note, *supra* note 18, at 458. EMEP is a permanent forum for inter-governmental negotiation on this issue and acts as a depository for all data on long-range transmission of air pollutants collected within Europe. *Id.*

42. EMEP Protocol, *supra* note 40, at arts. 3-4.

43. J. BRUNNEE, *supra* note 17, at 182.

44. Protocol to the 1979 Convention on Long-Range Transboundary Pollution on Reduction of Sulphur Emissions or Their Transboundary Fluxes by at Least 30%, *adopted and opened for signature* July 8, 1985 (*entered into force* Sept. 2, 1987), *reprinted in* 27 I.L.M. 698, 707 (1988) [hereinafter SO₂ Protocol]. This protocol was ratified by: Austria, Bulgaria, Byelorussia S.S.R., Canada, Czechoslovakia, Denmark, Finland, France, Federal Republic of Germany, Hungary, Liechtenstein, Luxembourg, the Netherlands, Norway, Sweden, Switzerland, Ukrainian S.S.R., and the U.S.S.R. *Id.* at 698. The U.K., U.S., Poland and Spain, all major industrial pollution source states, have not ratified this protocol. Pallemmaerts, *supra* note 10, at 198.

45. SO₂ Protocol, *supra* note 44, at 698.

46. Note, *supra* note 18, at 469-70.

47. See J. BRUNNEE, *supra* note 17, at 11-12 (discussing how sulphur emissions are generated and released into the atmosphere). Sulphur emissions are released in the combustion of fossil fuels for energy production and through numerous technological processes in the industrial sector. *Id.* at 182.

48. SO₂ Protocol, *supra* note 44, at art. 2. The reductions are calculated using 1980 national annual emission levels as the baseline year. *Id.* Article 3 makes clear that the 30% reduction is not the acceptable level of emissions but only a starting point for further reductions. SO₂ Protocol, *supra* note 44, at art. 3. Article 3 specifically states that "[t]he Parties recognize the need for each of them to study at the national level the necessity for further reductions, beyond those referred to in article 2, of sulphur emissions or their transboundary fluxes when environmental conditions warrant." *Id.*

toloc also requires parties, without undue delay and within the framework of the Geneva Convention, to develop national programs reducing sulphur emissions or their transboundary fluxes.⁴⁹

Although this protocol was a major achievement in creating a legal obligation to reduce pollution, there are two major criticisms of this program. First, the thirty percent reduction level is arbitrary and only constitutes a "first step."⁵⁰ This reduction level does not take into account the fact that certain nations emit more pollution than others and that certain areas especially sensitive to acid deposition damage may require increased levels of protection.⁵¹ Further, article 2 only requires that national emissions be reduced and allows each party discretion as to the implementation of the reduction.⁵² This may allow specific sources of damaging pollution to continue to emit sulphur pollutants at current or even increased levels.⁵³

The second major criticism is the selection of 1980 as the baseline year.⁵⁴ This selection is also arbitrary and puts the nations which reduced their sulphur emissions prior to 1980 at a disadvantage to those that did not.⁵⁵ These two criticisms suggest that the protocol had more to do with negotiation than with meaningful reduction to a level necessary for environmental protection and beneficial change.⁵⁶

Although the SO₂ Protocol has been criticized, it is important for two reasons. It is the first agreement to create a legal obligation to reduce transboundary air pollution, even if only by a flat rate percentage.⁵⁷

The language of the entire protocol clearly states that this is not the final word on SO₂ emissions and that continued reduction is necessary. Pallemmaerts, *supra* note 10, at 199.

49. SO₂ Protocol, *supra* note 44, at art. 6. Article 6 requires:

The parties shall . . . develop without undue delay national programmes, policies and strategies which shall serve as a means of reducing sulphur emissions or their transboundary fluxes, by at least 30 per cent as soon as possible and at the latest by 1993, and shall report . . . progress towards achieving the goal to the Executive Body.

Id.

50. Note, *supra* note 18, at 470.

51. *Id.* Many parties recognize that greater reductions are necessary to halt the problems associated with acid rain. *Id.*

52. SO₂ Protocol, *supra* note 44, at art. 2. Only total national emission levels must be reduced; nothing in the language of the provision requires 30 percent reductions to be made at each source. *Id.*

53. Note, *supra* note 18, at 470-71. Under the reduction mechanism of the SO₂ Protocol, a party may reduce emissions from the sources which have the least adverse environmental impact and still meet the obligations of the protocol. *Id.* at 470.

54. *Id.*

55. *Id.*

56. *Id.* at 469.

57. *Id.* at 471.

Further, the weakness of using a flat rate percentage reduction was sufficiently apparent to cause the consideration of other air pollution reduction methods.⁵⁸ The SO₂ Protocol achieved actual reductions in the levels of sulphur emissions⁵⁹ and a number of the parties have pledged to reduce their sulphur emissions beyond the thirty percent level.⁶⁰

D. PROTOCOL CONCERNING THE CONTROL OF EMISSIONS OF NITROGEN OXIDES OR THEIR TRANSBOUNDARY FLUXES

On November 1, 1988, the Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution Concerning the Control of Emissions of Nitrogen Oxides or Their Transboundary Fluxes (NO_x Protocol) was adopted in Sophia, Bulgaria.⁶¹ The agreement calls for parties to limit or reduce their nitrogen oxides (NO_x) emissions to the level of a specific base-line year.⁶² The limits imposed by this protocol caused great concern because the control techniques and costs for NO_x reduction were not well known.⁶³ Another concern was that reducing emissions requires decreased use as well as stringent emission standards of major sources of NO_x emissions such as automobiles.⁶⁴

The most important provisions of the NO_x Protocol are articles 2 and 5. Article 2 contains the basic obligations of the protocol.⁶⁵ Paragraph 1 establishes the reduction schedule and calculation method.⁶⁶ Para-

58. *Id.* at 472.

59. *Id.* at 471.

60. *Id.* As of 1988, ten parties had pledged to reduce their emissions by 50% by 1995. *Id.* Four of these pledged to reduce their emissions to 33% of their 1980 levels. *Id.*

61. Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution Concerning the Control of Emissions of Nitrogen Oxides, *adopted and opened for signature* Nov. 1, 1988, *reprinted in* 28 I.L.M. 212 (1989). The protocol was ratified by: Austria, Belgium, Bulgaria, Byelorussia S.S.R., Canada, Czechoslovakia, Denmark, Finland, France, German Democratic Republic, Federal Republic of Germany, Greece, Italy, Liechtenstein, Luxembourg, the Netherlands, Norway, Poland, Spain, Sweden, Switzerland, Ukrainian S.S.R., U.S.S.R., United Kingdom, and the United States. *Id.*

62. NO_x Protocol, *supra* note 61, at art. 2 para. 1. This provision obligates parties to control or reduce their emissions or transboundary fluxes to the national level of emissions in 1987 or any other year that does not exceed the 1987 level. *Id.*

63. Note, *supra* note 18, at 472.

64. *Id.* NO_x also arises from stationary sources during the combustion process from oxidation of nitrogen contained in the fuel and in the surrounding air. *See id.* at 472 n.177.

65. NO_x Protocol, *supra* note 61, at art. 2.

66. NO_x Protocol, *supra* note 61, at art. 2, para. 1. The actual language of the protocol reads:

The Parties shall, as soon as possible and as a first step, take effective measures to control and/or reduce their national annual emissions of nitrogen oxide or their transboundary fluxes so that these, at the least by 31 December 1994, do

graph 2 obligates the parties to apply national annual emissions standards to new or substantially modified stationary sources and to new mobile sources (automobiles).⁶⁷ This paragraph also requires the introduction of pollution control measures for major existing stationary sources.⁶⁸ Paragraph 3 compels the parties to commence negotiations to further reduce NO_x emissions while taking into account scientific and technological developments and internationally accepted critical loads.⁶⁹ The parties must cooperate in the establishment of critical loads.⁷⁰ The use of critical loads is crucial because it links actual emissions reductions to substantive environmental goals.⁷¹

Article 5 requires the parties to review the protocol on a regular basis commencing within one year after the ratification of the protocol.⁷² This basic provision allows the protocol to develop at the same pace as the science and technology of NO_x emission reduction. Together, arti-

not exceed their national annual emissions of nitrogen oxides or transboundary fluxes of such emissions for the calendar year 1987 or any previous year to be specified upon signature of, or accession to, the Protocol, provided that in addition, with respect to any Party specifying such a previous year, its national average annual transboundary fluxes or national annual emissions of nitrogen oxides for the period from 1 January 1987 to 1 January 1996 do not exceed its transboundary fluxes or national emissions for the calendar year 1987.

Id. The last part of paragraph 1 prevents parties from increasing their emissions by choosing a year other than 1987 which has a higher annual emissions level. *Id.*

67. NO_x Protocol, *supra* note 61, at art. 2, para. 2(a)-(b). These obligations are qualified by being based on the "best available technologies which are economically feasible." *Id.*

68. NO_x Protocol, *supra* note 61, at art. 2, para. 2(c). This obligation is qualified by taking into consideration "the characteristics of the plant, its age and its rate of utilization and the need to avoid undue operational disruption." *Id.* Unlike the CO₂ Protocol, this protocol covers existing stationary sources. *Id.* Unfortunately the largest source of NO_x emissions, existing mobile sources, are conspicuous in their absence. *Id.*

69. NO_x Protocol, *supra* note 61, at art. 2, para. 3(a). Paragraph 3(a) states: The Parties shall, as a second step, commence negotiations, no later than six months after the date of entry into force of the present Protocol, on further steps to reduce national annual emissions of nitrogen oxides or transboundary fluxes of such emissions, taking into account the best available scientific and technological developments, internationally accepted critical loads and other elements resulting from the work programme undertaken under article 6.

Id.

70. NO_x Protocol, *supra* note 61, at art. 2 para. 3(b). Critical loads are defined as "a quantitative estimate of the exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge." NO_x Protocol, *supra* note 61, at art. 1, para. 7.

71. Note, *supra* note 18, at 474.

72. NO_x Protocol, *supra* note 61, at art. 5. Article 5 states "[t]he Parties shall regularly review the present Protocol, taking into account the best available scientific substantiation and technological development. The first review shall take place no later than one year after the date of entry into force of the present Protocol." *Id.*

cles 2 and 5 require the parties to implement a coordinated, regional approach to address the problems of NO_x emissions.⁷³

The NO_x Protocol is important for a number of reasons. The most important is the subsequent establishment of critical loads.⁷⁴ The critical loads approach has several advantages over the flat rate percentage reduction approach used in the SO₂ Protocol. This approach links actual emissions reductions to specific environmental goals, something which arbitrary flat rate percentage reductions are unable to do.⁷⁵

Critical loads also protect specific ecosystems because the sources which have the greatest adverse effect or impact on sensitive elements of the environment will be subject to the most stringent regulation.⁷⁶ The sources subject to reductions are removed from the discretion of the parties and the decision is grounded in environmental need.⁷⁷ Under this approach, the parties coordinate their efforts and maximize the effect of the NO_x emissions reductions.⁷⁸

The NO_x Protocol is also important because of the emphasis it places on its regular review in light of the latest scientific and technological developments.⁷⁹ This approach ensures that the most advanced and cost effective science and technology will be incorporated in the protocol.⁸⁰

II. INTERNATIONAL AGREEMENTS ON OZONE LAYER DEPLETION

Steps were taken to protect the ozone layer prior to the implementation of the Vienna Convention for the Protection of the Ozone Layer (Vienna Convention). Chlorofluorocarbons (CFCs) were banned from use in aerosol propellants in North America in the 1970's because of concern over the destructive effects such substances had on the ozone layer.⁸¹ Other nations also expressed concern as to the effects of these

73. Note, *supra* note 18, at 475.

74. *Id.* at 474-75.

75. *Id.*

76. NO_x Protocol, *supra* note 61, at art. 1 para. 7. The determination of critical loads is made for numerous pollutants in various ecosystems. Note, *supra* note 18, at 474 n.198. This ensures that sources which have the greatest impact on the environment will be subject to the restrictions of the protocol. *Id.* at 474.

77. *Id.*

78. *Id.* at 475.

79. *Id.* at 476.

80. *Id.*

81. 43 Fed. Reg. 11,301 (1978). The Environmental Protection Agency and the Food and Drug Administration banned CFC use in aerosol propellants in 1978. *Id.* Speculation on whether the ozone layer was subject to depletion began in 1974. Rowland, *A Threat to Earth's Protective Shield*, EPA J., Dec. 1986, at 5.

substances on the ozone layer.⁸² The discovery of the hole in the ozone layer over Antarctica and ozone loss over North America only underscored the need for an international agreement to handle this potentially dangerous development.⁸³ The mounting scientific evidence concerning the severely effected condition of the ozone layer caused by the continued use of CFCs led directly to the implementation of the Vienna Convention.⁸⁴

A. VIENNA CONVENTION FOR THE PROTECTION OF THE OZONE LAYER

The Vienna Convention was adopted on March 22, 1985.⁸⁵ This agreement recognized the potentially harmful impact of ozone layer deterioration on the global environment and the need for further research and monitoring of ozone depleting CFCs.⁸⁶ The Vienna Convention, like the Geneva Convention, did not include any substantive pollution reduction measures or time tables for such reductions.⁸⁷ The Vienna Convention simply provided a framework for future cooperation and more specific obligations.⁸⁸

CFCs were invented in the 1930's for use in refrigeration. *Id.* CFCs are stable, non-toxic, and safe. Boyle, *Forecast for Disaster*, SPORTS ILLUSTRATED, Nov. 16, 1987, at 78, 81. They are used for air conditioning, refrigeration, and foams used in packaging and storage containers. *Id.* The same characteristics which make CFCs ideal for these uses also make them dangerous to the ozone layer. Rowland, *supra* note 81, at 5.

82. Wexler, *supra* note 17, at 6. UNEP is the source of the international consensus on ozone depletion. Smith, *The United Nations and the Environment: Sometimes a Great Notion?*, 19 TEX. INT'L L.J. 335, 338 (1984).

83. Wexler, *supra* note 17, at 3. NASA estimates a 1.7 to 3% loss, depending on latitude, in the ozone layer over the United States and Canada. *Id.* at 3 n.4. NOAA evidence shows increasing levels of chemicals in the arctic; existence of these chemicals is thought to precede ozone depletion. D. Dumanoski, *Arctic Data Raises Fear of Wider Ozone Depletion*, Boston Globe, Feb. 18, 1989, at 1. The level of lethal chemicals was 50 times higher than normal and comparable to that found in Antarctica where dramatic ozone depletion occurs in the spring. *Id.*

84. Wexler, *supra* note 17, at 1. Recent data has shown ozone depletion to be more widespread than previously thought. *Id.* at 3.

85. Vienna Convention for the Protection of the Ozone Layer, *adopted and opened for signature* Mar. 22, 1985 (*entered into force* Sept. 22, 1988), *reprinted in* 26 I.L.M. 1529 (1987) [hereinafter Vienna Convention]. The convention was ratified by: Argentina, Australia, Austria, Belgium, Brazil, Burkina Faso, Byelorussia S.S.R., Canada, Chile, China, Congo, Democratic Yemen, Denmark, Egypt, Federal Republic of Germany, Finland, France, Ghana, Indonesia, Israel, Italy, Japan, Kenya, Malaysia, Mauritius, Mexico, the Netherlands, New Zealand, Nigeria, Norway, Panama, Peru, Philippines, Portugal, Republic of Korea, Senegal, Sweden, Switzerland, Thailand, Togo, Uganda, Ukrainian S.S.R., U.S.S.R., U.K., U.S., Venezuela, and the E.E.C. *Id.*

86. J. BRUNNEE, *supra* note 17, at 229. For an explanation of how CFCs damage the ozone layer, see *id.* at 36-39.

87. *Id.* at 230.

88. *Id.* at 229.

Articles 2 through 5 contain the substantive obligations of the agreement. Although parties are not required to take any steps to prevent the depletion of the ozone layer, the parties are obligated to cooperate in the research and monitoring of ozone layer depletion.⁸⁹ Article 2 contains the agreement's general obligations. Under this provision, parties must take appropriate measures to protect human health and the environment from activities which deplete the ozone layer.⁹⁰ The parties also must cooperate in the scientific study of ozone layer depletion,⁹¹ in taking appropriate measures to combat continued modification of the ozone layer,⁹² in formulating measures to address the problem of ozone layer depletion,⁹³ and in implementing the agreement itself. These obligations can become more specific depending on agreement among the parties on future protocols under the Convention.⁹⁴

Articles 3, 4, and 5 contain obligations that expand cooperation and the exchange of information in the fields of research, monitoring, and assessment.⁹⁵ These obligations mirror the parties' recognition that before any reduction measures can be imposed, further research and study is required.⁹⁶ These provisions are crucial because much of the

89. Vienna Convention, *supra* note 85, at art. 2, para. 2.

90. Vienna Convention, *supra* note 85, at art. 2, para. 1.

91. Vienna Convention, *supra* note 85, at art. 2, para. 2(a). This provision requires cooperation in research and information exchange to facilitate a better understanding of the ozone depletion problem. *Id.*

92. Vienna Convention, *supra* note 85, at art. 2, para. 2(b). This provision requires "[C]ooperation in taking appropriate legislative or administrative measures and in harmonizing appropriate policies to control, limit, reduce or prevent human activities . . . which have or are likely to have adverse effects resulting from ozone layer modification." *Id.*

93. Vienna Convention, *supra* note 85, at art. 2, para. 2(c). The provision requires cooperation in formulation of agreed measures, procedures, and standards for the implementation of this convention, with a view to the adoption of protocols. *Id.*

94. J. BRUNNEE, *supra* note 17, at 230.

95. Vienna Convention, *supra* note 85, at arts. 3-5. Article 3 focuses on research and systematic observations. Vienna Convention, *supra* note 85, at art. 3. It outlines specific areas which need research and scientific assessment, calls upon parties to promote or establish joint or complementary programs for systematic observation of the ozone layer, and requires cooperation in the collection and transmission of research and observational data. *Id.*

Article 4 focuses on cooperation in the legal, scientific, and technical fields. Vienna Convention, *supra* note 85, at art. 4. This provision obligates the parties to facilitate and encourage data and information relevant to the Vienna Convention. *Id.* The information is supplied to bodies agreed upon by the parties and is to be kept confidential until it is available to all parties. *Id.* Information exchange must be consistent with the national laws, regulations and practices regarding patents, trade secrets, and protection of confidential and proprietary information. *Id.*

Article 5 simply requires the parties to keep the conference of parties informed of the measures they are taking in this regard. Vienna Convention, *supra* note 85, art. 5.

96. J. BRUNNEE, *supra* note 17, at 229.

relevant information on alternative technologies for CFCs is well guarded and commercially valuable.⁹⁷

The Vienna Convention is important for many reasons. First, in the same manner that the Geneva Convention recognized the problem of long-range transboundary air pollution, the Vienna Convention recognizes the adverse effects that modification of the ozone layer has on the global environment.⁹⁸ This agreement puts the topic on the table for international discussion, research, and action.⁹⁹

The construction of the Vienna Convention is also important. This umbrella agreement allows the adoption of further protocols which can be more specific and detailed as more information becomes known about the dangers to the ozone layer and the remedies for the problem.¹⁰⁰ In this regard, the Vienna Convention serves as a very important first step in combatting ozone layer depletion.¹⁰¹

B. PROTOCOL ON SUBSTANCES THAT DEplete THE OZONE LAYER

The Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol) was adopted and signed on September 16, 1987.¹⁰² This pro-

97. *Id.* at 232. Information on alternative substances to CFCs and alternative technology is primarily in private hands and would not be made available for fear that a competitor would gain access to it. *Id.*

98. *Id.* at 229.

99. *Id.*

100. *Id.* at 230-31. Article 2, which contains the general obligations of the convention, is constructed to increase in specificity depending on the protocols agreed upon. *Id.* The provision is also able to expand as knowledge of the dangers to the ozone layer increases since "activities which modify or are likely to modify the ozone layer" trigger the obligation. *Id.*

101. *Id.* at 229.

102. Montreal Protocol on Substances that Deplete the Ozone Layer, *adopted and opened for signature* Sept. 16, 1987 (*entered into force* Jan. 1, 1989), *reprinted in* 26 I.L.M. 1541 (1987) [hereinafter Montreal Protocol]. The protocol was ratified by: Belgium, Canada, Denmark, Egypt, Federal Republic of Germany, Finland, France, Ghana, Italy, Japan, Kenya, Mexico, the Netherlands, New Zealand, Norway, Panama, Portugal, Senegal, Sweden, Switzerland, Togo, the U.K., the U.S., Venezuela, and the E.E.C. *Id.* See generally Doniger, *Politics of the Ozone Layer*, ISSUES SCI. & TECH., 86 (1988) (stating that standards tougher than the Montreal Protocol are required); Comment, *Thinning Air, Better Beware: Chlorofluorocarbons and the Ozone Layer*, 6 DICK. J. INT'L L. 87 (1987) (discussing the need for an international agreement to combat ozone layer destruction); Note, *The Montreal Protocol on Substances that Deplete the Ozone Layer: Can It Keep Us All from Needing Hats, Sunglasses, and Suntan Lotion?*, 11 HASTINGS INT'L & COMP. L. REV. 509 (1988) (reviewing the Montreal Protocol to determine its sufficiency in arresting ozone layer depletion); Comment, *The Montreal Protocol: The First Step Toward Protecting the Global Ozone Layer*, 20 N.Y.U.J. INT'L L. & POL. 793 (1988) (stating that reductions beyond those required under the Montreal Protocol are necessary to respond to ozone layer depletion); Comment, *The Montreal Protocol: Confronting the Threat to Earth's Ozone*

to the Vienna Convention contains three important articles which regulate the production and consumption of CFCs¹⁰³ and halons.¹⁰⁴

Article 2 outlines CFC and halon control measures.¹⁰⁵ This article initially limits CFC consumption and production to current levels in 1990.¹⁰⁶ Parties must then reduce consumption and production levels by twenty percent by 1993¹⁰⁷ and by fifty percent by 1998.¹⁰⁸ Parties must also freeze halon consumption and production by 1992.¹⁰⁹ Article 2 allows smaller producing countries to transfer production¹¹⁰ and al-

Layer, 63 WASH. L. REV. 997 (1988) (discussing the causes of ozone layer depletion and the Montreal Protocol's response).

103. Montreal Protocol, *supra* note 102, at annex A. This provision lists CFC-11, CFC-12, CFC-113, CFC-114, and CFC-115 as controlled substances under the agreement. *Id.*

104. *Id.* The agreement lists halon-1211, halon-1301, and halon-2402 as controlled substances subject to regulation. *Id.*

105. Montreal Protocol, *supra* note 102, at art. 2. "Consumption" is defined as "production plus imports minus exports of controlled substances (CFC's or halons)." Montreal Protocol, *supra* note 102, at art. 1, para. 6.

106. Montreal Protocol, *supra* note 102, at art. 2. CFC consumption is to be limited, by 1990, to the calculated level of consumption of 1986. *Id.* A party producing CFCs may exceed its calculated 1986 level of production by ten percent if necessary to satisfy domestic need. *Id.* "Production" is defined as "the amount of controlled substances produced minus the amount destroyed by technologies to be approved by the Parties." Montreal Protocol, *supra* note 102, at art. 1 para. 5.

Under this provision, production is calculated by multiplying annual production of each controlled substance by its ozone depleting potential and adding together imports and exports, respectively, and consumption. Montreal Protocol, *supra* note 102, at art. 3. The use of an adjusted production level ensures that both producing parties and importing parties have an incentive to sign the agreement. Benedick, *Ozone Diplomacy*, ISSUES SCI. & TECH. 43, 49 (1989).

107. Montreal Protocol, *supra* note 102, at art. 2, para. 3. This provision requires a reduction to 80% of their 1986 levels. *Id.* The ten percent exception still applies if necessary to satisfy domestic need. *Id.* Under this exception a qualifying party would only have to reduce consumption and production to 90% of their 1986 levels. *Id.*

108. Montreal Protocol, *supra* note 102, at art. 2, para. 4. Parties must reduce their consumption and production levels to 50% of their 1986 levels. *Id.* Parties may exceed this production limit by 15% if: (1) necessary to satisfy domestic needs of parties operating under Article 5; and (2) for the purpose of industrial rationalization. *Id.* "Industrial rationalization" is defined as "the transfer of all or a portion of the calculated level of production of one party to another, for the purpose of achieving economic efficiencies or responding to anticipated shortfalls in supply as a result of plant closures." Montreal Protocol, *supra* note 102, at art. 1, para. 8.

109. Montreal Protocol, *supra* note 102, at art. 2, para. 2. As of 1992, parties may not exceed their 1986 level of consumption. *Id.* Production must be similarly limited except it may exceed the 1986 level by ten percent in the case of necessity to satisfy basic domestic needs of parties subject to article 5 and for purposes of industrial rationalization. *Id.* No further reductions of halon consumption or production are included in the protocol. *Id.*

110. Montreal Protocol, *supra* note 102, at art. 2, para. 5. A party whose 1986 CFC production level is less than 25 kilotons may transfer to or receive from another party excess production if the combined total of the two parties does not exceed the applicable limits. *Id.*

lows countries with long-range plans to maintain their objectives by adding to production.¹¹¹

Article 4 regulates the trade of CFCs and halons with non-parties.¹¹² This provision bans trade in controlled substances,¹¹³ as well as products containing controlled substances, with non-parties.¹¹⁴ The protocol requires consideration of a ban on products produced with, but not containing, controlled substances within five years.¹¹⁵ Article 4 also discourages the export of technology and financial support for production or utilization of controlled substances.¹¹⁶

Article 5 outlines the special situation of developing countries under this agreement. Countries listed by the United Nations as "lesser developed countries"¹¹⁷ qualify under this article. The article allows develop-

111. Montreal Protocol, *supra* note 102, at art. 2, para. 6. A party not subject to article 5 that has CFC producing facilities under construction or contract and provided for in national legislation prior to 1987 may add production generated from such facilities to their 1986 levels of production if such production does not raise per capita CFC consumption above 0.5 kilograms. *Id.* This article specifically applies to the U.S.S.R. which was constructing large CFC production facilities at the time of the 1987 negotiations. Tripp, *The UNEP Montreal Protocol: Industrialized and Developing Countries Sharing the Responsibility for Protecting the Stratospheric Ozone Layer*, 20 N.Y.U.J. INT'L L. & POL. 733, 737 n.16 (1988).

112. Montreal Protocol, *supra* note 102, at art. 4.

113. *Id.* at para. 1-2. The import of controlled substances from non-parties is banned within a year after the protocol enters into force. *Id.* Controlled substances are defined as "a substance listed in Annex A (CFCs and halons) to this Protocol, whether alone or in a mixture." Montreal Protocol, *supra* note 102, at art. 1, para. 4. The definition of controlled substances excludes "any such substance or mixture which is in a manufactured product other than a container used for the transportation or storage of the substance listed." *Id.*

Developing countries subject to article 5 must stop exporting controlled substances to non-parties by 1993. Montreal protocol, *supra* note 102, at art. 4, para. 2. The import bans outlined in article 4 are not applicable to non-parties in full compliance with articles 2 and 4. Montreal Protocol, *supra* note 102, at art. 4, para. 8. The inclusion of the trade measures marks a concerted effort by the parties to make the effect of this protocol as broad and wide ranging as possible. J. BRUNNEE, *supra* note 17, at 238.

114. Montreal Protocol, *supra* note 102, at art. 4, para. 3. Within three years of entry into force, the parties must establish an annex listing products containing the controlled substances and within one year must ban the import of such products. *Id.* This ban is only applicable to parties that have not objected to the annex. *Id.* This clause was included due to the unwillingness of some parties to commit to any ban without specific knowledge of which products would be covered. J. BRUNNEE, *supra* note 17, at 246.

115. Montreal Protocol, *supra* note 102, at art. 4, para. 4. The ban becomes effective one year after such determination. *Id.*

116. Montreal Protocol, *supra* note 102, at art. 4, paras. 5-7. The export of technology for producing and utilizing CFCs or halons is discouraged and the parties agree to refrain from new financial support for the export of products or technology which would facilitate the production of controlled substances. *Id.*

117. J. BRUNNEE, *supra* note 17, at 246. The developing states under the Montreal Protocol are: Afghanistan, Albania, Algeria, Angola, Antigua and Barbuda, Argentina, Bahamas, Bahrain, Bangladesh, Barbados, Belize, Benin, Bhutan, Bolivia, Botswana,

ing countries with a consumption level below 0.3 kg per capita to delay their compliance with article 2 by ten years if they do not exceed the 0.3 kg per capita consumption level.¹¹⁸ In addition, other parties agree to facilitate these developing countries' access to new and alternative technologies.¹¹⁹

The Montreal Protocol is important for a number of reasons. First, the gradual phase out of global emissions provides parties with sufficient time to develop and implement new or alternative technologies.¹²⁰ The protocol covers a wide range of CFCs and halons — more than originally addressed during the negotiations.¹²¹ The coverage of halons is critical because although CFCs are released at rates forty times higher, halons' ozone depletion potential is eight times higher.¹²²

The provision restricting trade with non-parties broadens the scope of the agreement by indirectly applying the weight of the agreement against the entire global community.¹²³ The approach taken must be global because ozone depletion is a global problem. Reducing the market for goods which contain or are produced with controlled substances is an effective measure to reduce the possible advantage gained by refusing to sign the treaty.¹²⁴ Without this provision, importing countries would have to bear the brunt of reductions if producing nations in-

Brazil, Brunei Darussalam, Burkina Faso, Burma, Burundi, Cameroon, Cape Verdi, Central African Republic, Chad, Chile, China, Colombia, Comoros, Congo, Costa Rica, Cote d'Ivoire, Cuba, Cyprus, Democrtatic Kampuchea, Grenada, Guatemala, Guinea, Guinea Bissau, Guyana, Haiti, Honduras, India, Indonesia, Iran, Iraq, Jamaica, Jordan, Kenya, Republic of Korea, Kuwait, Laos People's Democratic Republic, Lebanon, Lesotho, Liberia, Libyan Arab Jamahiriya, Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Mauritania, Mauritius, Mexico, Mongolia, Morocco, Mozambique, Namibia, Nepal, Nicaragua, Niger, Nigeria, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Phillipines, Qatar, Romania, Rwanda, St. Christopher and Nevis, St. Lucia, St. Vincent and the Grenadines, Samoa, Sao Tome and Principe, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Singapore, Solomon Islands, Somalia, Sri Lanka, Sudan, Suriname, Swaziland, Syrian Arab Republic, Thailand, Togo, Tonga, Trinidad and Tobago, Tunisia, Uganda, United Arab Emirates, United Republic of Tanzania, Uruguay, Vantuat, Venezuela, Viet Nam, Yemen, Yugoslavia, Zaire, Zambia, and Zimbabwe. *Report of the First Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer, done at Helsinki, May 6, 1989, U.N. Doc. UNEP/O2L.Pro.1/5 at 18-19.*

118. Montreal Protocol, *supra* note 102, at art. 5, para. 1.

119. Montreal Protocol, *supra* note 102, at art. 5, para. 2-3.

120. J. BRUNNEE, *supra* note 17, at 242-45.

121. *Id.* at 242. Although CFCs 11, 12, 113, and 114 were clearly going to be covered, the status of CFC 115 and halons 1211, 1301, and 2402 was unclear. *Id.*

122. See MacKenzie, *High Noon for Ozone in Montreal*, NEW SCIENTIST, Sept. 3, 1987 at 24 (describing the effects of both CFCs and halons on the ozone layer).

123. J. BRUNNEE, *supra* note 17, at 238.

124. *Id.*

creased their domestic consumption.¹²⁶ Thus, an incentive exists for importing nations to sign the protocol because only exports to non-parties have to come out of domestic consumption.¹²⁶

Of course, developing countries are not subject to the phase out provisions if their consumption rate is below a certain per capita level.¹²⁷ This allows the developing countries to use the technology and products on a small scale.¹²⁸ Signature to the treaty is actually beneficial because the industrial nations agree to give the developing nations access to new and alternative technologies and products.¹²⁹ Recognizing the interests of developing nations is an important element in encouraging them to sign on to the treaty.¹³⁰

III. UNITED STATES CLEAN AIR ACT AMENDMENT OF 1990

President Bush signed the Clean Air Act Amendment¹³¹ on November 15, 1990, in a ceremony at the East Room of the White House.¹³² The new law provides for many new standards for pollutants in the atmosphere and tougher regulation and enforcement of both the new and existing standards.¹³³ The amendment contains comprehensive provisions covering acid deposition and stratospheric ozone layer depletion, as well as indirect controls on emissions of some greenhouse gases.¹³⁴ The Clean Air Act Amendment is important to this analysis because it contains provisions which must be included in any effective global warming agreement.

125. *Id.* The CFC producing countries tend to be the industrialized nations while the developing countries are the importing nations. Tripp, *supra* note 111, at 744.

126. Benedick, *supra* note 106, at 49. Importing nations that did not become parties to the agreement would risk losing access to their supplies. *Id.*

127. Montreal Protocol, *supra* note 102, at art. 5, para. 1.

128. J. BRUNNEE, *supra* note 17, at 250.

129. *Id.* at 247.

130. *Id.* at 238-39.

131. Clean Air Act Amendments of 1990, Pub. L. No. 101-549, 104 Stat. 2399 (1990) (amendments to be codified at 42 U.S.C. § 7401 et seq.). The Clean Air Act Amendments of 1990 amend the Clean Air Act, Pub. L. No. 95-95, 91 Stat. 385 (1977) (codified at 42 U.S.C. § 7401 et. seq.).

132. Comment, *Great Expectations: Reviewing the 101st Congress*, 21 ENVTL. L. REP. NEWS & ANALYSIS 10008, 10016 (1991).

133. *Id.* at 10017-19.

134. *Id.* at 10016-17.

A. ACID DEPOSITION AND LONG-RANGE TRANSBOUNDARY AIR POLLUTION

Titles I, II, and IV of the Clean Air Act Amendment regulate and control the emissions which contribute to acid rain.¹³⁵ Title IV establishes the acid rain control program.¹³⁶ This program caps utility emissions of SO₂ at 8.9 million tons per year by the year 2000;¹³⁷ industrial emissions of SO₂ at 5.6 million tons per year once such a level has been reached;¹³⁸ and reduces utility emissions of NO_x by 2.0 million tons per year by 1996.¹³⁹ This title also provides for the allocation of pollution allowances.¹⁴⁰ Plants which have emission rates below the cap may accrue allowances for later use or for transfer or sale to other plants which exceed the emissions cap.¹⁴¹

135. Clean Air Act Amendments of 1990 tit. I-II, IV, Pub. L. No. 101-549, 104 Stat. 2399 (1990) [hereinafter Clean Air Act Amendments of 1990].

136. Clean Air Act Amendments of 1990, § 401, 104 Stat. 2584 (1990).

137. Clean Air Act Amendments of 1990, § 401, 104 Stat. 2584 (1990) (creating Clean Air Act §§ 404-405 to establish utility emissions controls under the Acid Rain Control Program). SO₂ reductions from utility sources will be completed in two phases. *Id.*

Phase I SO₂ reductions are required from 111 large, dirty plants (100 megawatts or more with emissions rates above 2.5 lbs. per million British thermal unit (lbs./mm Btu)) listed in the text by Jan. 1, 1995. Clean Air Act Amendments of 1990 § 401, 104 Stat. 2584 (creating Clean Air Act § 404). Each listed source must reduce emissions to 2.5 lbs./mm Btu multiplied by the plant's annual average baseline fuel consumption in 1985-87. *Id.*

Phase II SO₂ reductions tighten the limits on large, dirty sources (75 megawatts or more and emission rates above 1.2 lbs./mm Btu) to 1.2 lbs./mm Btu multiplied the plant's fuel consumption baseline. Clean Air Act Amendments of 1990 § 401, 104 Stat. 2584 (creating Clean Air Act § 405). In addition small and clean plants (below 75 megawatts or with 1985 emission rates below 1.2 lbs./mm Btu) must also limit their emissions. *Id.* Many different formulas are used for small plants and clean units. *Id.*

138. Clean Air Act Amendments of 1990 § 406(b), 104 Stat. 2632. The EPA must inventory national annual SO₂ emissions from industrial sources by January 1, 1995. Once such level is expected to reach levels greater than 5.6 million tons per year, the EPA may take whatever measures appropriate to cap SO₂ emissions at 5.6 million tons annually. *Id.*

139. Clean Air Act Amendments of 1990 § 401, 104 Stat. 549 (creating Clean Air Act § 407). Utility units must meet the NO_x reduction levels by the same dates they must meet the SO₂ reduction requirements. *Id.* The NO_x emission rates for different types of utility units are capped at between 0.50 and 0.45 lbs./mm Btu. *Id.* The reduction provisions of this section are estimated by ICF Resources to reduce emissions by 2.0 million tons per year. *Clean Air Act Amendments of 1990*, ENV'T & ENERGY STUDY INST., Oct. 24, 1990, at 9 [hereinafter House-Senate Floor Brief].

140. Clean Air Act Amendments of 1990 § 401, 104 Stat. 2584 (creating Clean Air Act § 403). EPA may also allocate allowances which it creates, to apply to utilities which use emission scrubbing controls. *Id.*

141. Clean Air Act Amendments of 1990 § 401, 104 Stat. 2584.

Title II establishes tighter tailpipe emission standards for mobile sources.¹⁴² A two tiered system of tailpipe standards for new mobile sources will cause a sixty percent reduction in NO_x emissions under tier I by 1998.¹⁴³ The Environmental Protection Agency (EPA) would have to consider which tier II standards to implement by the turn of the century but if the EPA fails to take action, the standards would reduce tier I emission levels by half.¹⁴⁴ This title also requires the EPA to promulgate more stringent emissions requirements for all gasoline fueled motor vehicles.¹⁴⁵ Automobiles are a major source of NO_x emissions and more stringent tailpipe emission standards are an important NO_x reduction measure.¹⁴⁶

Title I revises the Clean Air Act requirements for areas that have not attained health based ambient air quality standards.¹⁴⁷ The Clean Air Act required states to establish pollution attainment plans for various types of atmospheric pollution.¹⁴⁸ Ozone, formed from volatile organic compounds and NO_x, is the major pollutant controlled by this provision.¹⁴⁹ This title requires that the same control requirements for ozone areas also apply to major sources of NO_x and sulphur oxides (SO_x).¹⁵⁰

142. 42 U.S.C. § 7521 (1977) amended by Clean Air Act Amendments of 1990 § 203, 104 Stat. 2474.

143. *Id.* This section sets tailpipe emission standards for model years after 1993. *Id.* Automobiles and light duty trucks under 3750 lbs. may not emit more than 0.4 or 0.6 grams per mile (gpm) of NO_x, depending on whether the useful life of the vehicle is 5 years/50,000 miles or 10 years/100,000 miles. *Id.* By 1994, 40% of new models must meet these standards, by 1995 80%, and by 1996 all new models must meet these standards. *Id.* Vehicles over 3750 lbs. and other heavy duty vehicles must meet different standards. *Id.*

144. *Id.* If the EPA does not make a determination as to new standards, new models after the year 2003 may emit no more than 2.0 gpm of NO_x. *Id.*

145. *Id.* These measures do not reduce NO_x emissions directly, the object of these regulations is to reduce hydrocarbon emissions and require the installation in motor vehicles of devices to signal when the emissions control systems are malfunctioning. *Id.*

146. J. BRUNNEE, *supra* note 17, at 12. Motor vehicles account for 40% of NO_x emissions. *Id.* Fossil fueled power plants, the next biggest source, account for 30% of NO_x emissions. *Id.*

147. Clean Air Act Amendments of 1990 tit. I, 104 Stat. 2399. This title provides additional provisions for ozone, carbon monoxide, and particulate matter nonattainment areas, as well as for areas designated nonattainment for SO₂, NO_x, and lead. *Id.*

148. *Id.*

149. House-Senate Floor Brief, *supra* note 139, at 2. VOCs, also known as hydrocarbons, are primarily emitted from fossil fuel combustion stationary sources and motor vehicles. *Id.* When VOC and NO_x are combined they form ozone, one of the greenhouse gases. *Id.*

150. Clean Air Act Amendments of 1990 § 106, 104 Stat. 2463 (creating Clean Air Act §§ 191-2 to establish nonattainment provisions for SO₂, NO_x, and lead). States which contain a nonattainment area for these substances must implement a plan within 18 months of the enactment of the Amendment that meets the requirements of the

These provisions are important for two reasons. First, the controls and restrictions placed on SO₂ and NO_x emissions from utility,¹⁵¹ industrial,¹⁵² and mobile sources¹⁵³ are substantial. Second, these restrictions are more stringent and comprehensive than the Geneva Convention or its protocols.¹⁵⁴ Many environmental groups have criticized the delay in the implementation of the pollution controls but the breadth and effect of the agreement cannot be ignored.¹⁵⁵

The allowance system established under Title IV provides an important incentive for the reduction of emissions below stipulated levels.¹⁵⁶ The allowance system operates by allowing utilities which can reduce emissions efficiently to do so while selling their allowances to utilities whose reductions would be more expensive.¹⁵⁷ This system cuts the total cost of emissions reductions¹⁵⁸ and encourages the use of new technology.¹⁵⁹

B. PROTECTION OF THE STRATOSPHERIC OZONE LAYER

Title VI of the Clean Air Act Amendment establishes a program for stratospheric ozone protection.¹⁶⁰ The program will phase out the production and consumption of substances destructive to the stratospheric

provisions for ozone nonattainment areas. *Id.* The specific requirements of the nonattainment plan provisions are outlined in Clean Air Act § 172(c)(1)-(9), 42 U.S.C. § 7502 (1977) amended by Clean Air Act Amendments of 1990 § 102, 104 Stat. 2410.

151. *See supra* notes 137, 139 and accompanying text (discussing Clean Air Act §§ 404-5 to establish utility emissions controls under the Acid Rain Control Program).

152. *See supra* note 138 and accompanying text (discussing the Clean Air Act Amendments of 1990).

153. *See supra* notes 142-46 and accompanying text (discussing the Clean Air Act Amendment requirements for motor vehicles).

154. *See supra* notes 24-78 and accompanying text (discussing provisions of the Geneva Convention).

155. Comment, *supra* note 132, at 10017.

156. Hershberg, *Buying and Selling the Right to Pollute*, COURIER J., Nov. 26, 1990, § B, at 8. Utilities which have clean burning fuel technology or capacity to spare can make millions of dollars per year off the sale of allowances. *Id.*

157. *Id.*

158. *Id.* The cost of buying allowances would be lower than the cost of implementing new technology for some utilities. *Id.*

159. *Id.* The use of pollution scrubbing technology would be encouraged because the cost of a scrubber would be offset by the value of the emissions allowances gained through its use. *Id.* One midwestern utility claims a scrubber would cut its emissions by 70,000 tons per year. *Id.* If allowances were worth \$600 per ton, a conservative estimate, the allowances gained would be worth \$55.8 million. *Id.* The annual cost of the scrubber, \$47.5 million, would be offset by the emissions reductions produced. *Id.*

160. Clean Air Act Amendments of 1990 tit. VI, Pub. L. No. 101-549, 104 Stat. 2584 (1990).

ozone layer.¹⁶¹ The most destructive CFCs, along with three halons and carbon tetrachloride, will be phased out of production and consumption by the year 2000.¹⁶² These requirements are more stringent than the Montreal Protocol both in the number of substances covered and the timetable to total phase out.¹⁶³

The production and consumption levels of hydrochlorofluorocarbons (HCFCs) are to be frozen by 2015 and phased out by 2030.¹⁶⁴ HCFCs

161. Clean Air Act Amendments of 1990 § 602, 104 Stat. 2648 (creating Clean Air Act §§ 604-5 to establish substances controlled by the Stratospheric Ozone Protection Program). Production means the manufacture of a substance from any raw material or feedstock chemical. Clean Air Act Amendments of 1990 § 602, 104 Stat. 2648 (creating Clean Air Act § 601(11) to define production under the Stratospheric Ozone Protection Program). Production does not include manufacture of any substance that is entirely consumed in the manufacture of another chemical or the reuse or recycling of a substance. *Id.* Consumption means the amount produced plus the amount imported minus the amount exported. Clean Air Act Amendments of 1990 § 602, 104 Stat. 2648 (creating Clean Air Act § 601(6) to define consumption under the Stratospheric Ozone Protection Program). This term is used in a manner consistent with the Montreal Protocol. *Id.* All regulations regarding the phase out of consumption of these substances are to be promulgated by the EPA and must follow the same schedule as the production phase out. Clean Air Act Amendments of 1990 § 602, Pub. L. No. 101-549, 104 Stat. 2648 (1990) (creating Clean Air Act § 604(c) to establish the consumption phase out provisions under the Stratospheric Ozone Protection Program).

162. Clean Air Act Amendments of 1990 § 602, 104 Stat. 2648 (creating Clean Air Act § 602(a) to list Class I substances under the Stratospheric Ozone Protection Program). Ozone depleting substances are divided in two classes, with Class I substances to be phased out of production by 2000. Clean Air Act Amendments of 1990, Pub. L. No. 101-549, § 602, 104 Stat. 2648 (1990) (creating Clean Air Act § 604(a)). Class I substances are further divided into groups which determines their baseline year. Clean Air Act Amendments of 1990 § 602, 104 Stat. 2648 (creating Clean Air Act § 602(a)). Class I substances include; (Group I) CFC-11, CFC-12, CFC-113, CFC-114, CFC-115; (Group II) halon-1211, halon-1301, halon-2402; (Group III) CFC-13, CFC-111, CFC-112, CFC-211, CFC-212, CFC-213, CFC-214, CFC-215, CFC-216, CFC-217; (Group IV) carbon tetrachloride; and (Group V) methyl chloroform. *Id.* Groups I and II use 1986 as their baseline year and Groups III, IV, and V use 1989 as their baseline year. Clean Air Act Amendments of 1990, Pub. L. No. 101-549, § 602, 104 Stat. 2648 (1990) (creating Clean Air Act § 601(2) to define baseline year). The phase out period is over 9 years, starting in 1991 and ending in 1999. Clean Air Act Amendments of 1990 § 602 104 Stat. 2648 (creating Clean Air Act § 604(a)). Methyl chloroform production and consumption will not be phased out until 2002. *Id.*

163. House-Senate Floor Brief, *supra* note 139, at 14. The Montreal Protocol covers CFC-11, CFC-12, CFC-113, CFC-114, CFC-115, halon-1211, halon-1301, and halon-2402. Montreal Protocol, *supra* note 102, Annex A. The Montreal Protocol does not require a total phase out of these ozone depleting substances but rather a freeze and then reduction of consumption. Montreal Protocol, *supra* note 102, at art. 2. The Clean Air Act Amendment thus covers a larger number of substances and has a more stringent reduction schedule than the Montreal Protocol. House-Senate Floor Brief, *supra* note 139, at 14.

164. Clean Air Act Amendments of 1990 § 602, 104 Stat. 2648 (creating Clean Air Act § 605(b)-(c) to establish Class II phase out procedures under the Stratospheric Ozone Protection Program). HCFCs are Class II substances and production must be frozen at an amount determined by EPA by 2015. *Id.* These substances must be phased out by 2030. *Id.* See Clean Air Act Amendments of 1990, Pub. L. No. 101-549, § 602,

are less destructive to the ozone layer¹⁶⁵ and are most likely the interim substitutes for CFCs.¹⁶⁶ For this reason, the phase out schedule is longer. Specific exceptions are provided for both CFC and HCFC phase outs.¹⁶⁷

The comprehensiveness of the Clean Air Act Amendment and its stringent phase out requirements are vital aspects of the legislation. It is a more powerful weapon in fighting ozone layer depletion than the Montreal Protocol.¹⁶⁸ This legislation removes not only the most destructive ozone depleting substances but also those which have relatively low depletion potentials.¹⁶⁹ These steps encourage the development of alternatives and more effectively reduce the danger posed to the environment by the depletion of the ozone layer.¹⁷⁰

C. THE REDUCTION OF GREENHOUSE GASES

The Clean Air Act Amendment controls and reduces the emission of greenhouse gases both directly and indirectly.¹⁷¹ Ozone and CFC emissions are directly controlled by the amendment; the control of ozone by Titles I and II¹⁷² and CFCs by Title VI.¹⁷³ CO₂, however, is indirectly

104 Stat. 2648 (1990) (creating Clean Air Act § 602(b) to list Class II substances subject to the phase out procedures under the Stratospheric Ozone Protection Program).

165. Clean Air Act Amendments of 1990, Pub. L. No. 101-549, § 602, 104 Stat. 2648 (1990) (creating Clean Air Act § 602(e) to list ozone depletion potentials for controlled substances under the Stratospheric Ozone Protection Program). Ozone-depletion potential means a factor reflecting the ozone-depletion potential of a substance as compared to CFC-11. Clean Air Act Amendments of 1990, Pub. L. No. 101-549, § 602, 104 Stat. 2648 (1990) (creating Clean Air Act § 601(10) to define ozone-depletion potential). The factor is based on a substance's atmospheric lifetime, the molecular weight of bromine and chlorine, and the substance's ability to be photolytically disassociated, and upon other factors determined to be an accurate measure of relative ozone-depletion potential. *Id.* The five most destructive CFCs have ozone-depletion potentials of 1.0, halon-2402 has an ozone-depletion potential of 10.0, while HCFC ozone-depletion potentials range from 0.02 to 0.1. Clean Air Act Amendments of 1990, Pub. L. No. 101-549, § 602, 104 Stat. 2648 (1990) (creating Clean Air Act § 602(e)).

166. House-Senate Floor Brief, *supra* note 139, at 14.

167. Clean Air Act Amendments of 1990, Pub. L. No. 101-549, § 602, 104 Stat. 2648 (1990) (creating Clean Air Act § 604(d) to establish exceptions to the phase out procedures under the Stratospheric Ozone Protection Program). Specific exceptions exist for the essential uses of methyl chloroform, medical devices, and aviation safety. *Id.*

168. House-Senate Floor Brief, *supra* note 139, at 14.

169. *See supra* notes 160-167 and accompanying text (discussing Clean Air Act Amendment § 602).

170. House-Senate Floor Brief, *supra* note 139, at 14.

171. Weisskopf & Booth, *In West, U.S. Stands Alone on Warming Issue; Europeans Display Unity on Stabilizing Gases*, Wash. Post, Nov. 6, 1990, at A5.

172. Clean Air Act Amendments of 1990 tit. I-II, Pub. L. No. 101-549, 104 Stat. 2399 (1990). Title I regulates ozone under the National Ambient Air Quality Stan-

controlled by Title IV.¹⁷⁴ Methane reduction is to be studied further under Title VI.¹⁷⁵ These provisions focus on combatting the problems of air pollution, ozone depletion, and acid deposition rather than attempting to diminish the greenhouse effect.

The amendment will reduce the emissions of some greenhouse gases.¹⁷⁶ The provisions, although a first step, are not a substitute for legislation specifically dealing with the problem of global warming.¹⁷⁷ While further study, as in the case of methane, is provided for, many environmental groups and other nations are calling for more substantive steps to be taken.¹⁷⁸ The Clean Air Act Amendment will have the

dards and Title II regulates the emissions of hydrocarbons and NO_x, which together form ozone, from mobile sources. *Id.*

173. Clean Air Act Amendments of 1990 tit. VI, Pub. L. No. 101-549, 104 Stat. 2399, 2650 (1990). See *supra* notes 147-157 and accompanying text (discussing how Title VI controls and regulates the release of CFCs).

174. Clean Air Act Amendments of 1990 tit. IV, Pub. L. No. 101-549, 104 Stat. 2399, 2584 (1990). Title IV controls the emissions of utility plants which generate power through the combustion of fossil fuels. *Id.* See *supra* notes 128-146 and accompanying text (discussing the provisions under Title IV of the Clean Air Act Amendment).

Although the Clean Air Act Amendment does not explicitly limit CO₂ emissions, CO₂ is conveyed into the atmosphere directly and indirectly through a process regulated by the legislation. GREENHOUSE EFFECT, *supra* note 3, at 8. The effect this legislation will have on the reduction of greenhouse gases is subject to much debate. Drozdiak, *U.S. Refuses to Pledge Limit on Greenhouse Gases Emissions*, Wash. Post, Nov. 8, 1990, at A22, col. 1. Dr. John Knauss, Chief of the National Oceanic and Atmospheric Administration, claims the revised Clean Air Act will lead to significant reductions in greenhouse gas emissions. *Id.* Environmental groups claim the EPA estimates CO₂ emissions will be reduced by 68 million tons over the next 10 years, this is only 2 percent of total U.S. output. *Id.*

175. Clean Air Act Amendments of 1990, Pub. L. No. 101-549, § 603, 104 Stat. 2670 (1990). Within 2 years the EPA must inventory the sources of methane emissions and promulgate economically justified actions to control and reduce methane concentrations from the sources identified during the inventory process. *Id.*

176. Drozdiak, *supra* note 174, at A22. The actual reductions are subject to dispute between the Bush administration and environmental groups. *Id.* The debate over the effect of the current legislation on the greenhouse effect was renewed when an EPA report claimed that recent measures taken by the U.S. would freeze CO₂ emissions at the 1987 level through 2000 and actually cut these emissions four percent by 2010. Stevens, *supra* note 20, at 18. The measures cited by EPA to have this effect include the Amendment and recent energy saving measures mandated by the Department of Energy (DOE). *Id.* These claims are disputed by environmental groups which believe specific targets must be set for actual reductions or freezes to work. *Id.*

177. Drozdiak, *supra* note 174, at A22.

178. Weisskopf & Booth, *supra* note 171, at A5. Eighteen West European countries, along with Japan, Australia, and other industrialized countries have committed to timetables reducing or stabilizing emissions of greenhouse gases, including CO₂, the most important greenhouse gas. *Id.* Germany has vowed to reduce greenhouse gas emissions by 30% within the next 15 years. Drozdiak, *supra* note 174, at A22.

effect of reducing the emissions of some greenhouse gases even though it will do so indirectly.¹⁷⁹

IV. RECOMMENDATIONS FOR A GLOBAL WARMING AGREEMENT

The global warming conference could be the turning point in the international effort to combat the greenhouse effect. To ensure a successful conference the parties must construct an agreement which brings all the important international players into the agreement process. The agreement should contain a broad and flexible convention in which the signatories acknowledge the problem, the need to take steps, and the willingness to obligate themselves to resolve the problem.

The convention should be followed by protocols which further define the problem and implement substantive measures to stabilize or reduce the emissions of greenhouse gases. These protocols must link actual reductions to environmental goals. If these steps are taken, substantive progress can be made in the fight against global warming.

These recommendations apply to the agreement necessary to adequately deal with global warming. This agreement may or may not be constructed at the global warming conference. Therefore, even if the global warming conference is unable to create an agreement to address the problem, these recommendations are important elements for any agreement effectively addressing the problems associated with the greenhouse effect.

A. THE CONVENTION

The Convention is the starting point for any international cooperative effort to reduce the emissions of greenhouse gases. It must provide a framework for future cooperation and specific obligations.¹⁸⁰ Flexibility within the Convention is important because it may promote a willingness for some countries to adopt it.¹⁸¹ The major accomplishment of the Geneva and Vienna Conventions was their recognition of the problems of transboundary air pollution and ozone depletion, and the need for international efforts to combat these problems.¹⁸²

179. Weisskopf, *supra* note 19, at A3. The measures passed to combat acid rain also reduce CO₂ emissions. *Id.*

180. J. BRUNNEE, *supra* note 17, at 229.

181. Note, *supra* note 18, at 457.

182. J. BRUNNEE, *supra* note 17, at 229.

1. Acknowledgement

The first part of the Convention on global warming must acknowledge the problem of global warming and the need to take substantive action to combat its effects.¹⁸³ The controversy over the certainty of the scientific evidence will make even this task difficult.¹⁸⁴ The Convention also should contain several general provisions which recognize the problem of global warming, mandate cooperation in studying the problem, and require cooperation in addressing the problem with specific substantive measures.¹⁸⁵

2. Basic Obligations

After a declaration that recognizes the problem of global warming and its potential detrimental effects on the planet, the Convention should create a number of general obligations. The first would obligate the parties to take appropriate measures to protect human health and the environment from the effects of global warming.¹⁸⁶

A second important obligation would require parties to cooperate in the scientific study of global warming.¹⁸⁷ Such an obligation would necessarily be specific as to how such cooperation is to manifest itself.¹⁸⁸

183. See *supra* notes 31-32, 90 and accompanying text (discussing the acknowledgement provisions in the Geneva and Vienna Conventions).

184. Weisskopf & Booth, *supra* note 171, at A5. There are deep divisions in the Bush administration on the question of the greenhouse effect. *Id.* EPA Administrator Reilly and Secretary of State Baker both support direct action on global warming. *Id.* White House chief of staff Sununu and science advisor Bromley both believe there is insufficient evidence of the greenhouse effect to warrant any direct action and have appeared to set the policy for the Bush administration. *Id.*

185. See *supra* notes 33-34, 91-93 and accompanying text (discussing the cooperation provisions of the Geneva and Vienna Conventions).

186. See *supra* notes 31-32, 90 and accompanying text (discussing the acknowledgement provisions of the Geneva and Vienna Conventions).

187. See *supra* notes 34, 90 and accompanying text (discussing the scientific study provisions of the Geneva and Vienna Conventions). This obligation is important for two reasons. First, it ensures that the most up to date scientific information is available to all parties and assists in the completion of research necessary to further understand the nature and extent of the problem. Kriz, *supra* note 2, at 2750. The U.S., which is responsible for 22% of the world's CO₂ emissions, is unwilling to take any substantive steps until the problem is more fully researched and there is stronger evidence of the problem. Drozdak, *supra* note 174, at A22.

Second, such an obligation would also ensure that no party could claim a lack of evidence necessary to agree to substantive reductions if all parties have the same information. *Id.*

188. See *supra* notes 34, 90 and accompanying text (discussing the scientific study provisions of the Geneva and Vienna Conventions).

The third obligation would require all parties to cooperate in formulating measures to address the problem of global warming.¹⁸⁹

Though these steps may seem insufficient, political reality and the nature of the global warming problem require that the agreement encompass as many nations as possible, especially major emitters of greenhouse gases. If a convention can be signed with these obligations then the next task of constructing new protocols, containing the specific reduction measures, can begin.

B. THE PROTOCOL(S)

The protocols to the Convention are the means by which the substantive reductions necessary to combat global warming will take place.¹⁹⁰ These agreements must link environmental goals to actual reductions, recognize the special needs of developing nations, provide an incentive to reduce emissions below the stipulated levels, and be as comprehensive in scope as possible. These objectives are necessary to ensure that the protocols effectively reduce greenhouse gas emissions.

1. Critical Loads

Tying actual emissions reductions to environmental goals is one of the most important requirements of the protocols.¹⁹¹ The critical loads approach determines the specific emissions level for each greenhouse gas below which harmful effects to the environment do not occur.¹⁹² Emissions would be capped at this level.¹⁹³ The use of critical loads ensures that the reduction of greenhouse gas emissions is directly related to the specific needs of the environment.¹⁹⁴

189. See *supra* notes 33-34, at 93 and accompanying text (discussing Article 6 of the Geneva Convention and Article 2 of the Vienna Convention). This obligation is general in nature, requiring parties to commit themselves to the general goal of combatting global warming without committing to any specific reductions. *Id.* This obligation would be similar to those contained in the Geneva and Vienna Convention. *Id.*

190. See *supra* notes 40-80, 102-130 and accompanying text (discussing the protocols to the Geneva and Vienna Conventions).

191. See *supra* notes 74-78 and accompanying text (analyzing the establishment of critical loads under the NO_x Protocol). The NO_x Protocol required the development of critical loads, the maximum level of NO_x emissions which would not cause adverse consequences to a specific environmental region. NO_x Protocol, *supra* note 61, at art. 2, para. 3(a). This was a significant advancement over the flat rate percentage reduction required by the SO₂ Protocol. Note, *supra* note 18, at 474.

192. See *supra* note 70 and accompanying text (discussing how critical loads are determined under the NO_x Protocol).

193. *Id.*

194. *Id.*

2. *Developing Nations Clause*

It may seem counterintuitive to allow certain nations not to make the same commitment to reduce global warming, but it is necessary to bring developing nations into the agreement.¹⁹⁵ Greenhouse gas emissions are tied to the combustion processes of industrialized nations.¹⁹⁶ It would be inequitable to require developing nations to bear a disproportionate cost of the remedy.¹⁹⁷ Therefore, a provision similar to Article 5 of the Montreal Protocol must be included in the protocols.

3. *Allowance System*

The protocol must also make the reduction of emissions below stipulated levels an attractive goal. This could be accomplished by establishing an allowance system.¹⁹⁸ Nations with emission rates below a stipulated level, determined by the critical load of the pollutant, could accrue allowances.¹⁹⁹

These allowances could be transferred or sold to nations that were unable to meet their emissions reduction levels.²⁰⁰ If total emissions were subject to a cap, such a process would not defeat the purpose of the treaty.²⁰¹ Such a system would not only provide an incentive to reduce emissions below the proscribed levels, but it would lower the cost of emissions reductions and encourage the development of new technology and recycling programs.²⁰²

195. See *supra* notes 117-119, 127-130 and accompanying text (discussing Article 5 of the Montreal Protocol). The Montreal Protocol solves this problem by providing for special treatment of developing countries. Montreal Protocol, *supra* note 102, at art. 5. This provision has two important components. *Id.* It delays the implementation of reductions for those nations that are developing countries and do not have per capita emission rates above a certain level. *Id.* It also requires industrialized nations to share alternative technology with the developing countries and assist them in acquiring such technology. *Id.*

196. GREENHOUSE EFFECT, *supra* note 3, at 8. The combustion of fossil fuels, which include oil, gas, and coal, is the major source of CO₂, the most important of the greenhouse gases. *Id.* Other sources of greenhouse gases include automobiles, industrial sources, and some natural sources. *Id.*

197. See Tripp, *supra* note 111, at 742 (discussing the inequity of developing nations having to bear large cost of CFC reduction when their consumption rate is far below that of the industrialized world).

198. See *supra* notes 140-141, 156-159 and accompanying text (discussing the allowance system of the Clean Air Act Amendments).

199. *Id.*

200. *Id.*

201. *Id.*

202. *Id.*

4. *Comprehensive Scope*

The protocol must be comprehensive, both in the types of substances covered as well as the types of sources regulated.²⁰³ Existing international agreements all suffer from loopholes which reduce the effect of the pollution reduction measures mandated by these agreements.²⁰⁴ The protocols must cover all the major sources, not only the most destructive ones.²⁰⁵ Therefore, the protocols should cover not just CO₂, but all greenhouse gases, and they should impose restrictions on all man-made sources of these gases.

V. CONCLUSION

The global warming conference should first adopt a broad convention which acknowledges the existence of the greenhouse effect and the need for measures to effectively deal with it. The convention should be an umbrella agreement which allows for more stringent protocols to be adopted. Once such a convention is signed, the conference should then formulate protocols which are comprehensive in scope and establish actual reductions tied to specific environmental goals.

Global warming is a problem which must be addressed. The use of the convention - protocol approach ensures that the global community will work together to find methods to deal with the problem. It also allows time for science to further determine the extent of the problem and how it can best be remedied. Success in constructing and implementing such an agreement fulfills the present generation's responsibility for stewardship while failure ignores the dangers posed by this phenomenon.

203. See *supra* notes 136-138, 151-155 and accompanying text (discussing the acid rain control program of the Clean Air Act Amendment).

204. See *supra* notes 31-34, 50-56, 87 and accompanying text (discussing the loopholes in the Geneva Convention, SO₂ Protocol and the Vienna Convention).

205. House-Senate Floor Brief, *supra* note 139, at 14. The Clean Air Act Amendment covers more ozone depleting substances than the Montreal Protocol. *Id.* See *supra* notes 161-167 and accompanying text (discussing the more stringent coverage of CFC's by the Clean Air Act Amendment).