

COMMENT

LORI B. TALBOT*

Recent Developments in the Montreal Protocol on Substances that Deplete the Ozone Layer: The June 1990 Meeting and Beyond

I. The Call for More Stringent Controls

With the ink still wet, an international agreement¹ designed to reduce ozone depletion needed immediate changes. Scientific data released after the signing of the Montreal Protocol affirmed the previously uncertain causal connection that links bromine and chlorine-containing compounds to depletion of the ozone layer.² Fortunately, the drafters recognized the need for flexibility in light of this uncertainty and provided for periodic assessments of the control measures based on scientific, environmental, technical, and economic information.³ Several factors were to test this flexibility at an early stage. First, not only were chloro-fluorocarbons (CFCs) and halons conclusively proved to be depleting the ozone

*J.D. Candidate, 1992, Southern Methodist University. Articles/Associate Comments Editor, THE INTERNATIONAL LAWYER.

1. Montreal Protocol on Substances that Deplete the Ozone Layer, *adopted and opened for signature* Sept. 16, 1987, 26 I.L.M. 1541 (1987) (entered into force Jan. 1, 1989) [hereinafter Montreal Protocol].

2. The Consumer Subcommittee of the Senate Commerce Committee, *Regulation of Ozone-Depleting Chemicals*, Fed. News Serv. (Fed. Info. Sys. Corp.) (Oct. 19, 1989), available in LEXIS, Nexis Library, Curmnt File (statement by Dr. Robert Watson, Chief of the Upper Atmospheric Research Tropospheric Chemistry Branch at the National Aeronautics and Space Administration (NASA), addressing the regulation of ozone-depleting chemicals).

3. The protocol established a review cycle beginning in 1990 with maximum intervals of four years thereafter. Montreal Protocol, *supra* note 1, art. 6, 26 I.L.M. at 1556.

layer, but their past and future impact was better defined, resulting in the realization of a more serious state of environmental affairs. Second, two other ozone depleters were discovered, carbon tetrachloride (CCl₄) and methyl chloroform. Third, supposedly safe substitutes, hydrochlorofluorocarbons (HCFCs), were also found to be depleting the ozone layer, although to a lesser degree. Finally, it was apparent that key developing countries such as China and India would not sign the protocol unless they received technical and financial support.

A. CONCLUSIVE PROOF OF PRESUMED OFFENDERS PROVIDES IMPETUS FOR CHANGE

The original protocol was based on knowledge that a significant hole in the ozone layer appears over the Antarctic each spring. At the time of signing, scientists only theorized that this seasonal depletion was attributable to CFCs. However, one month later, studies established strong correlations between levels of chlorine monoxide, a gas formed when CFCs disintegrate, and ozone depletion.⁴ The Ozone Trends Panel provided more startling data to fuel concern.⁵ This data indicated that between the years 1969 and 1986, thinning grew from 1.7 to 3 percent in the latitudes that include much of the United States, Canada, Western Europe, China, Japan, and the Soviet Union.⁶ Also, Alaska and Scandinavia realized a greater than 6 percent wintertime rate.⁷ Recent data indicate that the Arctic region contains the same disturbing chemistry that contributes to Antarctica's 50 percent wintertime ozone reduction.⁸ Originally, no clear evidence of any ozone loss over the Arctic existed, but scientists have since confirmed their suspicions that added urgency is imperative. A total ozone loss between 5 and 7 percent has been documented.⁹ Moreover, the Antarctic ozone hole is reportedly larger than was previously thought.¹⁰

4. Arjon Makhijani et al., *Still Working on the Ozone Hole: Beyond the Montreal Protocol*, TECH. REV., May-June 1990, at 52, 54. The second American National Ozone Expedition (NOZE II) and the international Airborne Antarctic Ozone Experiment found these strong correlations coupled with two explanations of why the North and South Poles are particularly damaged. First, stratospheric clouds containing ice particles supply the environment in which longer-lived chlorine molecules convert into chlorine monoxide. Second, these ice particles inhibit the formation of more stable compounds by tying up nitrogen. *Id.*

5. In March 1988 the NASA-sponsored team reported a more substantial ozone loss in the middle latitudes than computer-generated predictions had indicated. *Id.*

6. *Id.*; see also Melinda Beck & Mary Hager, *More Bad News for the Planet: A Grim Report on the Ozone*, NEWSWEEK, Mar. 28, 1988, at 63.

7. Beck & Hager, *supra* note 6. The Ozone Trend Panel's findings were three times greater than expected. *Id.*

8. Philip Shabecoff, *Arctic Expedition Finds Chemical Threat to Ozone*, N.Y. TIMES, Feb. 18, 1989, § 1, at 1 (nat'l ed.).

9. *Hole in Ozone Layer Found at North Pole Too; Destruction Not as Severe as in Antarctic*, WASH. POST, Mar. 16, 1990, at A10. Although losses of 15 to 17 percent were measured in certain places, the total decrease is not as drastic and is substantially less than the reported 50 percent total loss over the Antarctic. The Arctic's depletion rate may never match the Antarctic's since the air is not as cold and the surrounding vortex of winds needed to keep ice clouds and chlorine from dispersing is not as strong. However, the ingredients are there for severe depletion at sometime. *Id.*

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Still more recent findings portray an even graver picture. Data collected from balloon observations in the lower stratosphere indicate a more disturbing loss—a 10 percent reduction over the middle latitudes of Europe and North America.¹¹ This figure is consistent with other recent data collected from satellite measurements, thereby indicating that depletion is occurring at a more rapid rate than originally thought.¹² Perhaps even more startling is a reported 3 percent loss over the equator—an area where depletion is believed to be the least.¹³ At one time scientists believed that years of extreme losses were followed by years of less severity, but 1990 data indicate significant losses may occur every year.¹⁴ This loss is cause for concern since any decrease in ozone level translates to an increased penetration of harmful ultraviolet rays. In turn, the increase of ultraviolet rays leads to higher incidents of skin cancer and cataracts, damage to the immune system, lower crop yields, and disruption of the aquatic food chain.¹⁵

According to scientists, the 1987 protocol limits do not provide the necessary controls to reduce ozone depletion. Further, these limits come nowhere near the ultimate desire to eliminate the ozone hole. If the protocol were implemented with 110 percent compliance worldwide, the atmospheric chlorine levels today, approximately 3 parts per billion (ppb), would only slow down to a rate of 9 ppb by the year 2050 and 12 ppb in 2100.¹⁶ Even if CFC production were to cease immediately, a 97 percent wintertime reduction of the ozone layer over the Antarctic would continue for up to 100 years¹⁷ because the most common CFCs have atmospheric lifetimes of anywhere from 75 to 185 years.¹⁸ Consequently, protecting the ozone layer requires a complete worldwide elimination of CFCs and halons. Additionally, CCl₄, methyl chloroform, and substitutes such as HCFCs, which also contain harmful chlorine, must be banned.

10. See William K. Stevens, *Ozone Losses are Reported Wider than Thought*, N.Y. TIMES, Nov. 16, 1989, § A, at 17. Scientists reported an ozone loss extending 350 miles beyond the originally calculated Antarctic hole. This discovery points out the uncertainty surrounding the atmospheric processes that lead to ozone loss. *Id.*

11. Philip Shabecoff, *Scientists Report Faster Ozone Loss*, N.Y. TIMES, June 24, 1990, § 1 at 13. The lower stratosphere is where chlorine-laden chemicals react on the surface of dust and ice crystals, destroying ozone molecules. *Id.*

12. In 1989 scientists originally reported an atmospheric ozone depletion rate of 3 to 6 percent. *Id.*
13. *Id.*

14. See *Scientists Fear High Annual Antarctic Ozone Loss*, BOSTON GLOBE, Oct. 15, 1990 (National/Foreign), at 3p (city ed.). Three of the last four years show a strong depletion of ozone over the Antarctic which could translate into an additional 2 percent loss over the Southern Hemisphere. *Id.*

15. Beck & Hager, *supra* note 6. The EPA predicts that for each 1 percent thinning of the ozone layer there could be a 5 percent increase in nonmelanoma skin cancers and a 2 percent increase of melanoma. *Id.*

16. *Regulation of Ozone-Depleting Chemicals*, *supra* note 2. In 1974 CFCs created an atmospheric chlorine level of 1.8 ppb. Beck & Hager, *supra* note 6. When chlorine levels rise above 9 ppb, a potential 4 percent decrease in the ozone layer exists in the tropics and 12 percent at high latitudes. *Regulation of Ozone-Depleting Chemicals*, *supra* note 2.

17. Craig R. Whitney, *London Talks Hear Call for '97 Ban on Anti-Ozone Chemicals*, N.Y. TIMES, Mar. 6, 1989, § B, at 10.

18. Douglas Hunter Ogden, Comment, *The Montreal Protocol: Confronting the Threat to Earth's Ozone Layer*, 63 WASH. L. REV. 997, 999 (1988) (footnote omitted).

B. NEW OZONE OFFENDERS

Two widely used chemicals, CCl_4 and methyl chloroform, are not subject to the 1987 protocol despite their ozone depleting characteristics. In 1988 the United States alone produced 1.5 billion pounds of these chemicals and released more than 165 million pounds into the atmosphere.¹⁹ Neither of these chemicals had been systematically analyzed to determine their role in ozone depletion, although some evidence indicating damage potential was available.²⁰ Continued use of these chemicals could double, triple, or even quadruple chlorine levels.²¹ By eliminating these two chemicals, chlorine levels could be reduced to 3.5 ppb, thereby bringing the goal of 2 ppb within reach.²²

1. Carbon Tetrachloride (CCl_4)

The low cost of CCl_4 makes it extremely appealing to industry; its use is confined to two areas, as a solvent in metal-cleaning operations and in the manufacture of CFCs.²³ Due to its high toxicity, many countries, including the United States, have found substitutes for cleaning operations, confining CCl_4 to CFC manufacture.²⁴ However, many countries in the Third World and in Eastern Europe still rely on it heavily as a solvent.²⁵ This reliance is predicated on economics— CCl_4 is \$0.25 per pound while any substitute could run as much as \$1 per pound.²⁶ Moreover, once CFCs are phased out, substitutes such as HCFCs will cost several times as much.²⁷ This cost structure could operate as a disincentive to developing countries to eliminate CCl_4 .

The danger CCl_4 poses to the atmosphere is like that of CFCs—it does not break down in the lower atmosphere. Therefore, the chlorine survives to rise into the upper atmosphere where it destroys ozone molecules. As an ozone depleter it is 10 to 20 percent more powerful than the most potent CFC.²⁸ The 1987 protocol did not address CCl_4 's harmful potential since the EPA believed its use had significantly declined.²⁹ To the contrary, atmospheric levels are on the rise due to increased use by developing countries.³⁰ Practically, a total replacement

19. Linda Kanamine, *Ozone Treaty Will Force Changes in Consumer Goods*, GANNETT NEWS SERV., July 11, 1990, available in LEXIS, Nexis Library, Currnt File.

20. Makhijani, *supra* note 4, at 55.

21. *Id.*

22. *Regulation of Ozone-Depleting Chemicals*, *supra* note 2.

23. Makhijani, *supra* note 4, at 57.

24. *Id.*

25. Open vats of CCl_4 are not an uncommon sight in Third World countries. *Id.*

26. *Id.*

27. Third World reliance on CCl_4 may grow if CFC-113 is banned and the substitutes are cost prohibitive. Industrialized countries could contribute to this reliance by redirecting production capacities stifled by CFC phaseout. *Id.*

28. *Id.*

29. Kanamine, *supra* note 19.

30. Statement by Steve Seidel of the Environmental Protection Agency's (EPA) global change division. *Id.*

for CCl₄ as a solvent is available; however, a need may still exist for its use as a feedstock for CFC substitutes.³¹

2. Methyl Chloroform

The greatest threat methyl chloroform poses is its widespread use.³² Characteristics such as low flammability, relatively low toxicity, and high potential for recycling and recovery make it a popular solvent for many applications.³³ Industry uses it in both metal and electronic equipment cleaning; consumers are exposed to it in aerosols, coatings, and adhesives.³⁴ However, only 10 percent of the total methyl chloroform manufactured is attributable to consumer goods, making industry the most reliant on its continued availability.³⁵

A total phase-out of CFCs would leave methyl chloroform the single greatest ozone depleter. Chemically, its structure is not as threatening as the five regulated CFCs since it breaks down in the lower atmosphere.³⁶ However, widespread use accounts for approximately 15 percent of current atmospheric chlorine levels, which is four times greater than that of the primary CFC solvent, CFC-113.³⁷ United States' emissions of methyl chloroform have stabilized, but these levels could rise if other solvents are regulated so that it is relied upon as a substitute.³⁸

Conversely, a total phase-out of methyl chloroform would provide an immediate and significant impact on current chlorine levels. Methyl chloroform has a half-life of only six years, whereas two of the longest-lived CFCs have half-lives ten to twenty times greater.³⁹ Consequently, a much faster decline in ozone

31. Makhijani, *supra* note 4, at 58.

32. Because of its high demand, more methyl chloroform is produced on a yearly basis than all the CFCs combined. *Methyl Chloroform Is Seen as Major Problem for Ozone*, CHEM. MKTG. RPT., June 25, 1990, at 9 [hereinafter *Methyl Chloroform*].

33. *Id.*

34. The Natural Resources Defense Council (NRDC) identifies 141 household and office products that contain methyl chloroform. Examples are hair sprays, spot removers, solvents and cleaners, carpet cleaners, furniture polish, water repellents, insecticides, shoe sprays, and automotive products. *Id.*

35. The greatest use of methyl chloroform is in metal-cleaning and degreasing operations. Kanamine, *supra* note 19.

36. Makhijani, *supra* note 4, at 57. Methyl chloroform's depleting power is only 15 percent of CFC-11's, one of the most widely used CFCs. *Id.*

37. *Id.*; see also *Methyl Chloroform*, *supra* note 32 (industry views as a "bridge" chemical between CFCs and totally ozone-friendly substances).

38. EPA seeks restrictions on possible CFC-113 substitutes such as volatile organic solvents (VOCs), perchloroethylene, and trichloroethylene. These solvents either contribute to ground-level pollution or their toxicity poses health dangers. Makhijani, *supra* note 4, at 57. According to a Greenpeace study, if methyl chloroform is substituted for CFCs, it may account for 35 percent of all ozone damage by the year 2075. *Greenpeace Says Two Cleaning Solvents Should Be Covered by Montreal Protocol*, 12 Int'l Env't Rep. (BNA) No. 11, at 535 (Nov. 8, 1989) [hereinafter *Greenpeace*].

39. CFC-11 and CFC-12 are two of the longest-lived CFCs. Makhijani, *supra* note 4, at 57. The term "half-life" is simply described as the time required for a concentration of a substance to decay to one half of its original concentration.

depletion could be realized early.⁴⁰ This goal appears within reach. According to a United Nations Environment Programme (UNEP) evaluation, safe alternatives such as water-based cleaners can replace methyl chloroform in 90 to 95 percent of its uses.⁴¹ Nevertheless, alternatives pose their own problems.⁴² In addition, some industries will suffer unless safe, feasible alternatives can be developed.⁴³ A complete phase-out of methyl chloroform would reduce chlorine levels to around 3.5 ppb.⁴⁴ Even if methyl chloroform were phased out, however, other CFC substitutes could offset any benefit realized.

C. "SAFE" SUBSTITUTES AS OFFENDERS

Industry has taken the initiative in developing ozone-friendly alternatives—hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs). Large chemical companies such as DuPont and Allied Signal, pioneers in developing this technology, seek acceptance of these substitutes as the long-term solution.⁴⁵ Yet, whether these chemicals are a cure-all is debatable. They pose less of a threat to the ozone layer, either because they lack chlorine (HFCs) or they break down in the lower atmosphere (HCFCs).⁴⁶ Conversely, each poses its own risks to the environment.⁴⁷

Currently, the most widely available substitute, HCFC-22, is used in refrigeration systems, aerosols, foam blowing, and Styrofoam manufacturing.⁴⁸ Future uses of other HCFCs include automobile air conditioners and compressor-gas substitutes in refrigeration systems.⁴⁹ In short, HCFCs will fulfill needs where no other substitutes can. Once again, however, the wisdom of long-term reliance on these chemicals as a substitute for methyl chloroform is questionable.⁵⁰

40. By not banning methyl chloroform, any decrease in ozone destruction will not be readily apparent since any CFCs already emitted will continue to damage for decades. *Id.*

41. *Id.* But see *Methyl Chloroform*, *supra* note 32 (water-based cleaning systems may pose global warming problems by increasing the demand for fossil-fuel energy).

42. According to Dr. Paul Cammer, Halogenated Solvents Industry Alliance president, the proposed alternatives' toxicity, polluting capabilities, flammability, and explosiveness make them undesirable also. *Methyl Chloroform*, *supra* note 32.

43. Methyl chloroform's compatibility with the chemistry and complex technology of filmmaking make its use critical to that industry. Kanamine, *supra* note 19.

44. *Regulation of Ozone-Depleting Chemicals*, *supra* note 2.

45. Makhijani, *supra* note 4, at 58. The formation of a unique coalition of the largest international producers, called the Program for Alternative Fluorocarbon Toxicity Testing (PAFT), indicates the interest industry has in these alternatives. *See id.*

46. According to Dr. Watson, HCFC's "atmospheric lifetime" is only 15 to 20 years whereas CFC's is up to 175 years. *CFC Substitutes Must Eventually Be Banned to Maintain Ozone Layer*, NASA Expert Says, 12 Int'l Env't Rep. (BNA) No. 11, at 534 (Nov. 8, 1989) [hereinafter *CFC Substitutes*].

47. Both HCFC and HFC have global warming effects anywhere from one-third to two-thirds that of CFC-11. Currently, estimates of CFC contribution to global warming is about 15-25 percent. Makhijani, *supra* note 4, at 58.

48. *Id.*

49. *Id.*

50. Research indicates that HCFC-22 contributes to about 4 percent of the chlorine build-up in the atmosphere. *Id.*

Scientists maintain that an acceptable atmospheric chlorine level is not obtainable if HCFCs are not banned as well. A level of 2 ppb is the target, since at that point and below the annual Antarctic ozone hole will disappear.⁵¹ Calculations indicate that if all chlorine-containing chemicals were banned and HCFCs used temporarily, this goal could be reached in the year 2075.⁵² If each HCFC's lifetime is determined, then simple mathematical calculations can indicate when that particular HCFC must be banned to meet the 2075 goal.⁵³ Unfortunately, this stepped timetable may not be the solution either. Some scientists theorize that damage from HCFCs and other chemicals may rise due to an overburdened atmosphere incapable of rejuvenating itself from pollutants.⁵⁴ Whether HCFCs are viable alternatives, even if temporary ones, may be answerable as more scientific data become available. Until then, current data indicate sufficient cause for exercising the protocol's flexibility by controlling HCFCs also.

D. DEVELOPING COUNTRIES

Although the 1987 protocol made significant progress towards preserving the ozone layer, its own provisions coupled with a lack of full worldwide participation could defeat its goal. A Third World exemption allows participating developing countries actually to increase CFC use for a ten-year period before they must cut back to the 50 percent level imposed on developed countries.⁵⁵ This exemption does not give Third World countries carte blanche because consumption is restricted to .3 kilograms per capita per year.⁵⁶ Effectively, this provision only decreases overall CFC consumption by 35 percent, which is 15 percent shy of the protocol's goal.⁵⁷ Moreover, if China, Brazil, India, and Indonesia signed the protocol and exercised this exemption, the annual rate of CFC production would more than double.⁵⁸ The lack of full participation provides a more startling picture. If nonparticipating Third World countries consumed at rates comparable to developed countries, global use would triple.⁵⁹

Lack of participation is attributed to both the need for relatively low-cost modernization and the perception that the ozone-alert creators (the industrialized

51. *CFC Substitutes*, *supra* note 46.

52. *Id.*

53. In determining when banning must occur an HCFC's atmospheric lifetime is doubled to tripled then subtracted from 2075. *Id.* To illustrate, an HCFC with an atmospheric lifetime of fifteen years must be banned between the years 2030-2045.

54. Makhijani, *supra* note 4, at 58.

55. Montreal Protocol, *supra* note 1, art. 5, 26 I.L.M. at 1555.

56. *Id.* After the ten-year grace period ends, the party must use this measure or the average of its annual consumption between the years 1995 to 1997, whichever is lower, as a basis for compliance with article 2 control measures. *Id.* A 1987 report indicated that developing countries consumed 0.2 kilograms per capita per year. 18 Env't Rep. (BNA) No. 21, at 1347 (Sept. 18, 1987).

57. Makhijani, *supra* note 4, at 59.

58. *Regulation of Ozone-Depleting Chemicals*, *supra* note 2.

59. Makhijani, *supra* note 4, at 59. In 1990 India produced 10,000 tons to support its population. John Hunt, *Peking Set to Sign Accord on Ozone Layer*, FIN. TIMES, June 29, 1990, § 1, at 6.

nations) should shoulder all costs associated with Third World participation. Modernization efforts have led large Third World countries such as China and India to invest heavily in CFC-based technology.⁶⁰ Replacing such investments with proposed CFC substitutes is not appealing due to high costs. In 1987 the refrigerant CFC-11 cost \$0.50 per pound whereas the projected 1994 cost of HFC-134a, a substitute refrigerant, is \$3 per pound.⁶¹ Even if substitutes were not so costly, the equipment required to adopt their use is a major deterrent.⁶² Failure of wealthy nations to assist poorer ones in developing and acquiring new technologies for protocol compliance serves as a barrier in reducing ozone depletion.⁶³ The original protocol does recognize certain obligations to developing countries, yet it contains no mention of financial assistance.⁶⁴ Until Third World technical and financial needs are negotiated to their satisfaction, it appears that key players will prevent accomplishment of the protocol's goals.

II. The Call Is Answered

A. A NEW AGREEMENT WITH FINANCIAL SUPPORT

If both parties and nonparties to the original protocol were unaware of the deteriorating state of ozone affairs, they were educated on June 20, 1990. Findings of the U.K. Stratospheric Ozone Review Group were announced that provided an impetus for negotiation of a new agreement.⁶⁵ The resulting protocol was perceived as a "fairer and much more rigorous international agreement."⁶⁶ Evidence of approval came from ninety-three nations as opposed to only the fifty-seven acceding to the

60. Substantial investments involve CFC-based refrigeration. China has invested in twelve CFC production plants to provide its population of 1.1 billion with refrigerators. Larry B. Stammer, *Saving the Earth: Who Sacrifices?*, L.A. TIMES, Mar. 13, 1989, at 1. Fewer than one in ten Chinese families have a refrigerator. *Id.* Moreover, India's CFC use has increased 30 percent per year. Donella Meadows, *New Ozone Accord Is One Giant Step for Mankind*, L.A. TIMES, July 8, 1990, at M2.

61. Meadows, *supra* note 60.

62. Substitutes may require less desirable equipment due to energy inefficiency and lack of durability. *Id.*

63. *See id.* (Liu Ming-Pu, the Chinese environment commissioner, confirmed the impact of no support at the 1989 Saving the Ozone Layer Conference by stating that China would not participate unless it received support); *see also Stronger International Bodies Seen Emerging to Cope with Worldwide Environmental Issues*, 13 Int'l Env't Rep. (BNA) No. 6, at 252 (June 13, 1990) (developing countries need convincing that CFC substitutes can be produced and exported profitably to combat the idea that CFCs are key to modernization).

64. One provision requires parties to consider the special needs of developing countries in the development and exchange of technologies and alternatives. Montreal Protocol, *supra* note 1, art. 9, 26 I.L.M. at 1556. Another states that parties shall cooperate in promoting technical assistance in light of developing countries' needs. *Id.* art. 10, 26 I.L.M. at 1557.

65. *See Parties to Montreal Protocol Agree to Phase Out CFCs, Help Developing Nations*, 13 Int'l Env't Rep. (BNA) No. 7, at 275 (July 11, 1990) [hereinafter *Help Developing Nations*].

66. *Id.* (Statement by Mostafa K. Tolba, executive director of the United Nations Environment Program [UNEP]).

1987 protocol.⁶⁷ The protocol appears to have met its first test of flexibility by accelerating phase-out of CFCs, adding other ozone-depleters to the ban list, and providing financial support to participating Third World countries.

After several days of negotiation, parties to the original Montreal Protocol reached a more aggressive and comprehensive phase-out plan. The new agreement accelerates CFC phase-out by calling for a 50 percent cut in their use by 1995, an 85 percent reduction by 1997, and a total phase-out by 2000.⁶⁸ This schedule does not apply to Third World nations, which will be given a ten-year grace period if they accede to the protocol.⁶⁹ Halons were given the same schedule as CFCs, except for the 1997 phase-out requirement.⁷⁰ But because halons are critical to certain applications, an exemption identifying permissible, limited uses saved them from total demise.⁷¹ Effectively, these measures accelerated the original protocol's goals.

Further, the call for acknowledging additional depleters was answered. Methyl chloroform must be reduced 70 percent by 2000 with a total phase-out by 2005.⁷² In addition, CCl₄ is targeted for an 85 percent reduction by 1995 with total phase-out by 2000.⁷³ Although a concrete plan exists for these two chemicals, the same cannot be said for HCFCs. Reference is made to an eventual HCFC phase-out date ranging from the year 2020 to 2040, but details were deferred to a separate declaration.⁷⁴ The new protocol only addresses HCFCs by warning nations to use them responsibly.⁷⁵ Overall, a weak protocol was successfully strengthened.⁷⁶

Perhaps even more significant than a revised schedule was the establishment of a fund designed to assist Third World countries. This is the first time that the

67. Malcolm W. Browne, *93 Nations Move to Ban Chemicals that Harm Ozone*, N.Y. TIMES, June 30, 1990, § 1, at 1. Only the parties to the Montreal Protocol were allowed to vote on this agreement.

68. *Help Developing Nations*, *supra* note 65. This schedule goes far beyond the 1987 protocol that sought only a 20 percent reduction by 1993 and 50 percent by 1998. See Montreal Protocol, *supra* note 1, art. 2(3)-(4), 26 I.L.M. at 1552.

69. Browne, *supra* note 67. Third World countries must cease production by the year 2010. *Id.* Two Third World countries, Mexico and Brazil, have already begun their phase-out of CFCs. Their actions leave some doubt whether most Third World countries will take advantage of the full grace period. R.C. Longworth, *Ozone Protection Pact Sets Global Precedent*, CHI. TRIB., June 30, 1990, (News) at 1.

70. *Help Developing Nations*, *supra* note 65. The 1987 protocol only calls for a 1992 freeze of all consumption and production at 1986 levels. See Montreal Protocol, *supra* note 1, art. 2(2), 26 I.L.M. at 1552.

71. Specialized uses such as in fire-fighting systems, aircraft, and manned computer rooms are exempt from the halon phase-out provision. *Help Developing Nations*, *supra* note 65.

72. *Id.*

73. *Id.*

74. *Id.*

75. *Id.* The UNEP believes this puts industry on notice that the search for HCFC substitutes must begin immediately. *Id.*

76. Success may be attributable to the perceived availability of feasible substitutes in the near future. Larry B. Stammer, *Ozone Accord Spurs Drive on Global Heating*, L.A. TIMES, July 2, 1990, at A1.

national governments of developed countries have voted to provide developing countries with financial assistance for reaching environmental goals.⁷⁷ Initially, the fund will provide either \$160 million or \$240 million over the first three years,⁷⁸ depending upon whether China and India participate. If these two countries ratify the new protocol, an additional \$80 million over and above the \$160 million base amount will be provided.⁷⁹ In meeting this monetary goal, the United States has pledged a 25 percent contribution, translating to either \$40 million or \$60 million.⁸⁰ Britain has pledged a minimum contribution of \$9 million, with a possible increase to \$15 million.⁸¹ Ensuring successful fund administration is the function of a newly created executive committee.⁸² The fourteen-member rotating committee will always consist of seven industrial and seven less-developed nations, each serving three-year terms.⁸³ However, the substantial U.S. contribution has earned that nation a permanent seat on the committee.⁸⁴ Once again, this fund is a significant step towards ensuring developing countries' participation. Not surprisingly, though, some assert the financial support is inadequate. India's Environment Minister, Manka Gandhi, maintains that their \$40 million allocation is insufficient to meet a possible \$600 million project.⁸⁵ Most of the Third World countries contend that the \$240 million fund is "insignificant" and that additions to the fund would not be overly demanding since CFC-generated tax revenue will total \$8 billion over the next five years.⁸⁶ Whether the fund can adequately accommodate all Third World needs will probably provide the impetus for another gathering of the nations.⁸⁷

77. *The Ozone Layer: The Lady Turned*, ECONOMIST, July 7, 1990, at 43 [hereinafter *Lady Turned*].

78. Browne, *supra* note 67.

79. *World Ozone Pact Reached*, FACTS ON FILE WORLD NEWS DIG., July 13, 1990, at 512, available in LEXIS, Nexis Library, Currt File [hereinafter *Ozone Pact*].

80. *Id.* The 25 percent figure is based on the U.S. United Nations subscription. *U.S. Pledges \$60 Million to Anti-CFC Fund*, INTER PRESS SERV., June 28, 1990, available in LEXIS, Nexis Library, Currt File [hereinafter *U.S. Pledges*]. This share will eventually amount to approximately two cents of every dollar received from an excise tax imposed on the CFC industry. Meadows, *supra* note 60.

81. *Help Developing Nations*, *supra* note 65. The \$15 million contribution will result if China and India accede to the protocol. *Id.* West Germany has surpassed Britain by pledging \$24 million. *U.S. Pledges*, *supra* note 80.

82. The World Bank will release the funds. *Help Developing Nations*, *supra* note 65.

83. Browne, *supra* note 67. The first members will consist of Canada, Germany, Finland, the Netherlands, Japan, Brazil, Egypt, Ghana, Jordan, Malaysia, Mexico, Venezuela, the Soviet Union, and the United States. Finland will serve as chair for the first year. *Id.*

84. *Help Developing Nations*, *supra* note 65.

85. *Technology Transfer Issue Hobbles World CFC Accord*, 238 Chem. Mktg. Rep. (Info. Access Co.) No. 2, at 20 (July 9, 1990) [hereinafter *Technology Transfer*]. India estimates a \$600 million bill resulting from industry's retooling efforts in using alternative technologies. *Id.*

86. *U.S. Pledges*, *supra* note 80. According to William Reilly, U.S. Environmental Protection Agency Administrator, U.S. industry has already accumulated a \$3 billion research bill in pursuit of CFC substitutes. *Id.*

87. Originally, the proposed fund only provided \$100 million to developing countries. See *Environment Ministers Support Funding Plan to Help Developing Nations Cut Use of CFCs*, 13 Int'l Env't Rep. (BNA) No. 6, at 225 (June 13, 1990) [hereinafter *Funding Plan*]. This change of position indicates future fund expansion is possible.

B. AN ATMOSPHERE OF FRICTION, LEADING TO CONCESSIONS

Preliminary negotiations and the June 1990 meeting itself were not without their share of disagreements and accusations. Dissension focused on three areas: funding, a phase-out timetable, and transfer of technology. Fortunately, the meeting sought to address and resolve all concerns, precluding a premature dissolution with no new agreement.

Until a few weeks before the meeting, concern about the possibility of establishing a fund was well-founded. Preparatory meetings indicated the United States' support in helping developing countries, but its goals for accomplishing aid were not aligned with those of the European Community (EC).⁸⁸ While EC ministers had not agreed on the degree of financial support and the management of such a fund, they cohesively supported establishment of financial aid.⁸⁹ This EC agreement placed international pressure on the United States to conform, which it did.⁹⁰ Another reason for the United States' change in position was the meeting of certain "essential criteria" established for any fund proposal.⁹¹ Consequently, when the parties met in June no real opposition had emerged to bar critical financial assistance. However, the United States did exhibit concern over the precedent-setting implications of such a fund.⁹² The parties addressed this concern by incorporating a clause explicitly stating no precedent had been set.⁹³

88. During the Geneva meeting, May 8–11, 1990, the United States proposed financial assistance through existing organizations (the World Bank) and with existing monetary resources. *Id.*

89. Internal struggle over allocation of costs to developed countries did not deflect the EC. While some Member States favored contribution based on U.N. subscriptions, others desired allocation based on a country's production and consumption rate (the higher the rate, the more that country would contribute). *Id.* In the end, the EC ministers agreed on former means of determining contribution.

90. On June 15, 1990, the Bush administration announced support for a fund to aid less developed countries (LDCs). *Bush Administration to Propose Fund to Help Countries Control CFC Emissions*, 21 *Env't Rep.* (BNA) No. 8, at 372 (June 22, 1990) [hereinafter *Bush Administration*]. The announcement delivered by John Sununu, White House Chief of Staff, was not only ironic, but rare. Originally, Sununu led the opposition to U.S. involvement in such funds, much to the dismay of the EPA administrator. *CFC Fund Finally Wins Backing of Administration; International Fund for Chlorofluorocarbons Phase Out in Developing Countries*, 237 *Chem. Mktg. Rep.* (Info Access Co.) No. 26, at 3 (June 25, 1990) [hereinafter *Backing of Administration*]. Usually, announcements of this nature are issued in the name of the President or press secretary, not the chief of staff. *Bush Administration, supra*. Senator Gore of Tennessee immediately followed up on President Bush's approval by introducing a bill authorizing the U.S. contribution to the international account. 20 *Env'tl. L. Rep.* (Env'tl. L. Inst.) 10311 (July 1990).

91. According to Sununu, President Bush established the following "essential criteria" for any such funding mechanism: "adequate scientific evidence" showing the cause-effect relationship of ozone depletion, "strong evidence" that the fund "successfully address[es]" the problem, and the "reasonable and predictable" nature of the necessary associated expenses. *Backing of Administration, supra* note 90.

92. The United States did not want its action perceived as establishing a financial obligation in resolving other environmental issues, such as global warming. Stammer, *supra* note 76. Concern for shouldering global warming financial aid may be premature. Some doubt such aid could meet all of the President's "essential criteria," specifically that programs could be reasonably expected to resolve global warming and that the required funding would be "limited and reasonably predictable." *Id.*

93. Longworth, *supra* note 69. Nevertheless, most delegates, including Americans, agreed that in devising financial means for coping with such a key environmental problem an important precedent was set. *Id.*

Another issue prior to and during the meeting was the phase-out deadline. While the EC opted for total phase-out by 1997, the United States insisted on an additional three years.⁹⁴ The modified protocol yielded to U.S. desires, yet some members of the EC made a separate pact to meet the 1997 goal.⁹⁵ Within two years, the parties will reevaluate this deadline to see if a faster phase-out is feasible.⁹⁶

Perhaps the most significant source of conflict involved technology transfer.⁹⁷ Both India and China made it clear that funding was not enough and that their ratification depended on access to new technologies.⁹⁸ India was particularly disturbed by the phrasing in the original protocol, which stated that parties will "take every practical step to ensure that the best available technology would be transferred,"⁹⁹ since the wording provided little assurance that actual transfer would occur. Consequently, the new agreement incorporated special provisions allowing developing countries the right to appeal if they did not receive effective technology.¹⁰⁰ Much to the developing countries' dismay, the industrialized parties made no concession to relinquish patent rights.¹⁰¹ This aspect of the dispute involves two conflicting interests. On the one hand, industry has invested millions of dollars to research and develop alternatives, and any relinquishment of technology would undercut sales.¹⁰² On the other hand, developing nations cannot continually purchase products from the West due to an already burdensome foreign debt.¹⁰³ Despite this conflict, a satisfactory deal may have been struck. Western transnationals have proposed joint venture projects aimed at

94. *Funding Plan*, *supra* note 87. Japan and the Soviet Union also resisted a faster schedule, preferring a longer deadline to ensure the availability of safe substitutes. Longworth, *supra* note 69. The EC Council desired CFC elimination to occur by 1997, but it was agreeable to a 2000 date if developing countries were induced to sign the protocol. *Funding Plan*, *supra* note 87.

95. In a separate statement twelve European countries and Canada committed themselves to a 1997 phase-out. Longworth, *supra* note 69. Industry is concerned that widespread adoption of an earlier phase-out might operate to undermine investment in CFC substitutes. Emma Chynoweth, *Tougher CFC Rules are Adopted*, CHEM. WK., July 4, 1990, at 12.

96. The protocol parties agreed to review the year 2000 deadline at another conference in 1992. *Help Developing Nations*, *supra* note 65. Reilly has suggested that western phase-out could occur sooner than 2000. Longworth, *supra* note 69.

97. This perception is based on the emphasis that key developing countries placed on the issue during the June 1990 meeting.

98. Longworth, *supra* note 69. Delegates from India, Malaysia, and other Third World countries sharply accused the United States of "economic imperialism" in forcing them to abandon American-sold CFC technology without guaranteeing access to alternatives. Browne, *supra* note 67.

99. *Technology Transfer*, *supra* note 85.

100. *Ozone Pact*, *supra* note 79. A committee will adjudicate any noncompliance issues. The initial committee members are Trinidad, Tobago, Hungary, Uganda, Norway, and Japan. *Ozone Sets Pattern for Greenhouse Diplomacy*, POWER ASIA, July 16, 1990 (Energy), available in LEXIS, Nexis Library, Currnt File] [hereinafter *Ozone Sets Pattern*].

101. The industrialized nations viewed a waiver of patent laws as undermining established international patent and copyright protection treaties. *Ozone Sets Pattern*, *supra* note 100.

102. Stammer, *supra* note 76.

103. *Id.*

producing substitute chemicals in India.¹⁰⁴ These concessions appeared enticing to India and China, both delegates leaving the meeting confident their countries would ratify.¹⁰⁵

III. The Initial Call for Action

A. RECOGNIZING THE NEED FOR UNITY

In the beginning, no unity of action existed. Countries alerted to the ozone depletion problem acted disjunctively. Initially, U.S. federal agencies enacted regulations that sought a ban of CFC's use in nonessential aerosol products by 1978.¹⁰⁶ Other countries either followed the U.S. lead or enacted less effective measures.¹⁰⁷ Further U.S. legislative action in the form of Clean Air Act amendments also sought control of other CFC uses.¹⁰⁸ Yet, the United States realized the global nature of the issue and the minimal effect of any isolated acts. The UNEP was called upon to take international, proactive measures towards limiting CFC use.¹⁰⁹ In 1981, after several years of simply coordinating and monitoring research, the UNEP committed itself to develop an international framework for ozone protection.¹¹⁰ The product of their efforts was the Vienna Convention for the Protection of the Ozone Layer,¹¹¹ which provided for international concerted action in the areas of research, monitoring, and information exchange. Thus, the convention paved the way for a concrete plan of action.

B. CONCRETE ACTION TAKEN

While the Vienna Convention provided for concerted action, it lacked substance as to any concrete measures for actual ozone protection. Fulfillment of this

104. *Environment: Third World Compromise on CFC's?*, INTER PRESS SERV., June 29, 1990, available in LEXIS, Nexis Library, Currnt File [hereinafter *Compromise*]. DuPont qualifies entering a joint venture upon meeting three criteria: (1) retention of control over the technology, (2) control over safety standards, and (3) compensation for its involvement. *Lady Turned*, *supra* note 77. In turn, India is offering business partnerships with those transnationals that can export substitutes to other developing countries. *Compromise*, *supra*.

105. Both Maneka Gandhi and the Chinese delegation head asserted they would recommend ratification of the protocol as amended. *Help Developing Nations*, *supra* note 65.

106. Alice M. Noble-Alligire, Comment, *The Ozone Agreements: A Modern Approach to Building Cooperation and Resolving International Environmental Issues*, 14 S. ILL. U. L.J. 265, 271 (1990).

107. Canada and two Scandinavian countries fell in line with the United States, whereas the European Community merely suggested that their industries voluntarily reduce use by 30 percent. *Id.*

108. *Id.* See also 42 U.S.C. §§ 7450-7459 (1982). Unfortunately, efforts to control nonaerosol uses were in vain. See Noble-Alligire, *supra* note 106, at 272.

109. See Noble-Alligire, *supra* note 106, at 272.

110. See *id.*

111. Vienna Convention for the Protection of the Ozone Layer, Mar. 22, 1985, 26 I.L.M. 1516 (1987) [hereinafter Vienna Convention]. In March 1985 twenty countries and the EC adopted the convention. See Noble-Alligire, *supra* note 106, at 272. See generally *id.* at 275-78; JUTTA BRUNNÉE, ACID RAIN AND OZONE LAYER DEPLETION: INTERNATIONAL LAW AND REGULATION 229-36 (1988) (discussion of the Vienna Convention's substantive provisions).

need was accomplished in 1987 by adopting the Montreal Protocol on Substances that Deplete the Ozone Layer.¹¹² The protocol targets specific CFCs for reduction in production and consumption along with freezing levels of three halons.¹¹³

The protocol's preamble provides insight into the basis for adopting its provisions. Its purpose is "to protect the ozone layer by taking precautionary measures to control equitably total global emissions of substances that deplete it, with the ultimate objective of their elimination on the basis of developments in scientific knowledge, taking into account technical and economic considerations."¹¹⁴ Further, in conjunction with pursuit of its purpose, the protocol acknowledges "that special provision is required to meet the needs of developing countries for these substances."¹¹⁵ Three provisions, articles 2,¹¹⁶ 4,¹¹⁷ and 5¹¹⁸ are specifically aimed at balancing the need for effective control measures along with Third World economic interests. Thus, achieving equity is the overall objective. Analysis of these provisions provides an understanding as to the renegotiations held in June 1990.

1. Control Measures

Article 2 mechanically provides a schedule in controlling production and consumption of CFCs and halons as follows:

(1) By July 1, 1989, the parties must freeze CFC production¹¹⁹ and consumption¹²⁰ at 1986 levels.¹²¹ As an exception, a 10 percent increase is allowable to meet "basic domestic needs" of developing countries under article 5 and for industrial rationalization¹²² between parties.¹²³

112. Montreal Protocol, *supra* note 1, 26 I.L.M. at 1541. The protocol officially entered into force on January 1, 1989, after ratification by at least eleven countries responsible for at least two-thirds of 1986 CFC consumption levels. *See id.* at 1559; *see also EC, Member States Ratify Protocol for Protecting Stratospheric Ozone*, 19 Env't Rep. (BNA) 1756 (Dec. 23, 1988) (EC and ten Member States ratify protocol, adding to sixteen nations that previously ratified).

113. Annex A categorizes the CFCs and halons into groups. Group I lists the five targeted CFCs as: CFC-11, CFC-12, CFC-113, CFC-114, and CFC-115. Group II lists the three halons as: halon-1211, halon-1301, and halon-2402. Montreal Protocol, *supra* note 1, 26 I.L.M. at 1561.

114. *Id.* at 1551.

115. *Id.*

116. Article 2 addresses specific control measures for limiting production and consumption of CFCs and halons. *See id.* art. 2, 26 I.L.M. at 1552-54.

117. Article 4 calls for a ban on CFC and halon trade with nonparty countries. *See id.* art. 4, 26 I.L.M. at 1554-55.

118. Article 5 provides a special ten-year exemption to developing countries that are parties to the protocol. *See id.* art. 5, 26 I.L.M. at 1555-56.

119. "Production" is "the amount of controlled substances produced minus the amount destroyed by technologies to be approved by the Parties." *Id.* art. 1(5), 26 I.L.M. at 1551.

120. "Consumption" is "production plus imports minus exports of controlled substances." *Id.* art. 1(6).

121. *See supra* note 113 (listing controlled CFCs).

122. "Industrial rationalization" is "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 1, art. 1(8), 26 I.L.M. at 1552.

123. *Id.* art. 2(1). This 10 percent increase is effective until June 30, 1998, at which time it can be increased to 15 percent. *See id.* art. 2(4).

(2) By January 1, 1992, the parties must freeze halon consumption at 1986 levels.¹²⁴ The same 10 percent allowance in article 2(1) is also applicable here.¹²⁵

(3) On July 1, 1993, the parties must reduce their CFC production and consumption levels to 80 percent of 1986 levels (20 percent reduction).¹²⁶

(4) On July 1, 1998, the parties must further reduce the CFC production and consumption levels to 50 percent of 1986 levels (another 30 percent reduction) unless a two-thirds majority vote blocks such a reduction. Notably, this decision is subject to assessments made under article 6.¹²⁷ Also, a 15 percent allowance to satisfy developing countries' basic domestic needs is given here (a 5 percent increase over the 1989 allocation).¹²⁸

Several exceptions affect the reduction schedule outlined above. First, any party whose 1986 production level of CFCs is less than twenty-five kilotons can transfer to or receive from any other party production in excess of the established limits, provided the total combined levels of production do not exceed limits established by the protocol.¹²⁹ Second, parties with CFC production plants either under construction or contracted for before September 16, 1987, can add the potential production to their 1986 levels to determine calculated levels of production for 1986.¹³⁰ Any exercise of these provisions must be communicated to the secretariat of the Convention prior to or at the time of transfer or addition.¹³¹ Last, parties that are member states of a regional economic integration organization can act cohesively in fulfilling consumption obligations, provided that their total does not exceed the article 2 protocol limits.¹³²

The remaining article 2 provisions have become essential to the protocol's continued effectiveness. Based on article 6 assessments, the parties may adjust production and consumption levels of the currently controlled CFCs and halons.¹³³ Additionally, substances can be added to or removed from any pro-

124. *Id.* art. 2(2); *see supra* note 113 (listing controlled halons).

125. Montreal Protocol, *supra* note 1, art. 2(2), 26 I.L.M. at 1552.

126. *Id.* art. 2(3).

127. As indicated, a provision exists for periodic assessment of scientific, environmental, technical, and economic information. *See supra* note 3 and accompanying text.

128. Montreal Protocol, *supra* note 1, art. 2(4), 26 I.L.M. at 1552-53.

129. *Id.* art. 2(5), 26 I.L.M. at 1553. This exception was made for purposes of industrial rationalization. *Id.*

130. *Id.* art. 2(6). This exception is subject to two restrictions: (1) these facilities must be completed by December 31, 1990, and (2) the production from these facilities must not raise the annual calculated level of consumption of CFC above 0.5 kilograms per capita. *Id.* The Soviet Union had threatened not to sign the protocol absent such a provision since they had recently adopted a five-year plan for CFC production. *See* Pamela Wexler, *Protecting the Global Atmosphere: Beyond the Montreal Protocol*, 14 MD. J. INT'L L. & TRADE 1, 13 (1990).

131. Montreal Protocol, *supra* note 1, art. 2(7), 26 I.L.M. at 1553.

132. *Id.* art. 2(8). The EC would be one such organization.

133. *Id.* art. 2(9)(a). Also, adjustment to Annex A ozone depleting potentials may be made. *Id.*; *see supra* note 127 for the assessment factors.

TOCOL annex.¹³⁴ Every effort must be made to reach a consensus on any recommended adjustments;¹³⁵ only as a last resort will a two-thirds majority representing at least 50 percent of the total consumption be sufficient to enact any changes.¹³⁶ Article 2 ends on a note of optimism: Even if the proper consensus to exact changes is not reached, individual action is allowed under subsection 11, which permits parties to take more stringent measures than those required by the protocol.¹³⁷

2. Control of Trade

The thrust of article 4 is global compliance. It seeks to limit CFC and halon emissions of nonparties while simultaneously encouraging those countries to join the protocol. These goals are effectuated by a ban of bulk imports from nonparties almost immediately and eventually of any products that either contain the controlled substances or are manufactured with them.¹³⁸ Exports are also controlled by prohibiting article 5 countries to trade with nonparties.¹³⁹ Further, any developed countries are dissuaded from trade with nonparties. After January 1, 1993, any substances exported to nonparties will be considered part of the exporting party's consumption level.¹⁴⁰ This last provision will make industrialized nations hesitate to export to nonparties since any exports will lower domestic consumption ability.¹⁴¹

Other article 4 provisions have the same effect as those above. Parties shall discourage the exporting of technology for producing and utilizing controlled substances.¹⁴² Any form of financial aid to nonparties for the export of products, equipment, plants, or technology that may facilitate production of controlled substances is prohibited.¹⁴³ However, exceptions to these restrictions will be made if the export improves containment, recovery, recycling, or destruction of controlled substances, or promotes the development of alternative

134. Montreal Protocol, *supra* note 1, art. 2(10), 26 I.L.M. at 1554.

135. *Id.* art. 2(9)(c).

136. *Id.*

137. *Id.* art. 2(11); *see supra* note 95 and accompanying text (showing how some parties exercised this provision at the June 1990 meeting).

138. Montreal Protocol, *supra* note 1, art. 4(1), (3), (4), 26 I.L.M. at 1554-55. Article 4(1) requires each party to ban imports from nonparties by January 1, 1990. *Id.* Article 4(3) requires development of an annex itemizing products containing controlled substances. This compilation must be completed by January 1, 1992; one year after its effectiveness, parties must ban the annexed products. *Id.* Article 4(4) requires parties to consider the feasibility of banning products produced with (not containing) the controlled substance. If feasible, an annex listing the products will be developed, with an import ban of these products to follow within one year. *Id.*

139. *Id.* art. 4(2), 26 I.L.M. at 1555.

140. *Id.* art. 3(c), 26 I.L.M. at 1554.

141. *See Noble-Alligire, supra* note 106, at 282 n.113 (example of how exporting after 1993 operates as a disincentive).

142. Montreal Protocol, *supra* note 1, art. 4(5), 26 I.L.M. at 1555.

143. *Id.* art. 4(6).

substances.¹⁴⁴ Together, these prohibitions and exceptions serve as inducement for nonparty compliance.

3. *Developing Countries Exemption*

Article 5 also seeks to encourage broad participation of developing countries. As indicated earlier, these countries are recognized as a special exception to the article 2 control measures. Delayed compliance is permissible if developing countries' annual calculated level of consumption of the annexed substances is less than 0.3 kilograms per capita as of January 1, 1989.¹⁴⁵ Only after ten years will developing countries be required to adhere to article 2 control measures.¹⁴⁶ At that time, further article 5 provisions should have ensured developing countries' compliance.¹⁴⁷ By its wording, this article seeks to achieve the equitable results expounded in the preamble.¹⁴⁸

4. *Boilerplate and Technical Provisions for Implementation*

The protocol contains standard treaty provisions allowing for interpretation and administration.¹⁴⁹ Other key provisions serve to effectuate the protocol's goals. Three articles provide the specifics on how to identify, change, and report on the article 2 control measures.¹⁵⁰ Also, special obligations of the parties are spelled out. First, at the parties' initial meeting, they are to develop procedures for determining noncompliance and for appropriate disciplinary actions.¹⁵¹ Second, the parties must cooperate in promoting research, development, and the exchange of information on the best technologies for reducing emissions, possible alternatives to controlled substances, and the costs and benefits of pertinent control strategies.¹⁵² Third, the parties will cooperate in promoting technical assistance for implementation of the protocol, paying

144. *Id.* art. 4(7).

145. *Id.* art. 5. The parties cannot exceed this level at any time. *Id.*

146. *Id.*

147. Two provisions require developed nations to facilitate access to alternatives and technology along with necessary financial aid. *See id.* art. 5(2)-(3), 26 I.L.M. at 1556.

148. *See supra* notes 114-15 and accompanying text.

149. These provisions include: Definitions (art. 1); Regular Meetings of the Parties (art. 11); Secretariat (art. 12); Relationship of the Protocol to the Vienna Convention (art. 14); Signature (art. 15); Parties joining after entry into force (art. 17); Reservations (art. 18); Withdrawal (art. 19); and Authentic Texts (art. 20). Montreal Protocol, *supra* note 1, 26 I.L.M. at 1550.

150. These three articles are 3, 6, and 7. Article 3 identifies how control levels are calculated for substances identified in Annex A. *Id.* art. 3, 26 I.L.M. at 1554. Article 6 provides for periodic assessment and review of the control measures. *Id.* art. 6, 26 I.L.M. at 1556. Article 7 sets out the parties' reporting requirements for production, exports, and imports of the controlled substances. *Id.* art. 7.

151. *Id.* art. 8.

152. *Id.* art. 9(1), 26 I.L.M. at 1556-57. The parties must, either individually or jointly, cooperate in promoting public awareness of the environmental effects of substances that deplete the ozone layer. *Id.* art. 9(2), 26 I.L.M. at 1557. In addition, to ensure their compliance with this provision, the parties must report their activities towards achieving the requisite cooperation. *Id.* art. 9(3).

special attention to the needs and circumstances of developing countries.¹⁵³ Last, funds required for effectuating the protocol shall be charged exclusively against party contributions, with the financial rules to be determined at the parties' first meeting.¹⁵⁴

C. SUBSEQUENT ACTION

As a precursor to further formal negotiations, the international community held conferences.¹⁵⁵ In March 1989 representatives from 124 nations gathered in London to discuss a tighter global agreement.¹⁵⁶ Prior to the meeting the twelvenation EC adopted a more rigorous phase-out schedule: 85 percent reduction effective "as soon as possible," with total elimination by the year 2000.¹⁵⁷ The next day the United States followed suit by also calling for a ban by 2000, provided safe alternatives are available.¹⁵⁸ Unfortunately, the London meeting did not succeed in convincing all delegates to sign an agreement for a total, worldwide ban.¹⁵⁹ Despite this failure, twenty additional countries committed to ratify the Montreal Protocol and a dozen others seriously considered joining.¹⁶⁰ In all, the London talks provided optimism for future consensus and paved the way for productive, formal negotiations.

More significant progress towards total phase-out occurred in May of 1989. Pursuant to article 11, the parties held their first formal negotiation in Helsinki. Here, delegates signed the Helsinki Declaration on the Protection of the Ozone Layer that called for a complete ban of CFCs by the year 2000 and a ban on halons as soon as feasible.¹⁶¹ This declaration is not binding on the signatories, yet it is significant in expressing the parties' intent and goals for the 1990

153. *Id.* art. 10.

154. *Id.* art. 13, 26 I.L.M. at 1559.

155. "Formal" negotiations are those required by the protocol. Article 11 states that the first meeting of the parties must take place no later than one year after the protocol's entry into force (Jan. 1, 1989). *Id.* art. 11, 26 I.L.M. at 1557.

156. Whitney, *supra* note 17.

157. *Id.*

158. *Bush Asks Ban on CFCs to Save Ozone; Urges End to Production by Year 2000 if Safe Alternatives Can Be Developed*, L.A. TIMES, Mar. 4, 1989, at 1. According to EPA officials, the EC's declaration provided incentive for the U.S. change in position. *Id.*

159. Craig R. Whitney, *20 Nations Agree to Joint Ozone Pact*, N.Y. TIMES, Mar. 8, 1989, § A, at 12. At the London meeting, China and India warned they would not comply unless developed countries assisted them in industrializing without CFC reliance. Frederic A. Moritz, *Third World and Ozone "Blackmail,"* CHRISTIAN SCI. MONITOR, Mar. 23, 1989, at 18. Both countries maintained that industrialized nations were making it difficult for them to become "first-class economic achievers." *Id.* This accusation is not unfamiliar. In their attempt to block nuclear weapon proliferation in 1968, the United States, Great Britain, and the Soviet Union were accused of preventing smaller countries from "joining the club." *Id.*

160. Whitney, *supra* note 159.

161. Helsinki Declaration on Protection of the Ozone Layer, May 2, 1989, 28 I.L.M. 1335-36 (1989).

meeting.¹⁶² Although the declaration provided optimism, some still disagreed on establishing an international fund to help developing countries comply.¹⁶³

As the June 1990 meeting moved closer, more meetings were held to ensure its success. In March 1990 a working group meeting considered and evaluated proposals for adjustments and amendments to the protocol.¹⁶⁴ Another meeting in May, though not focused solely on ozone depletion, proved to be the final pre-June consensus. Delegates from forty-two nations met to discuss the overall future of the global environment.¹⁶⁵ Here, the nations signed a Declaration of Environmental Interdependence¹⁶⁶ that addressed ozone depletion and other key environmental issues. More specifically, they adopted the following five-point plan for the June 1990 meeting in London:

- (1) expand coverage to all ozone-depleting substances to include methyl chloroform, HCFCs, and CCl₄;
- (2) accelerate the previously agreed-upon reduction schedule for production and use of ozone-depleting substances;
- (3) limit the growth of HCFCs;¹⁶⁷
- (4) Eliminate CFCs, halons, CCl₄, and methyl chloroform as soon as possible, but no later than January 1, 2000; and
- (5) eliminate HCFC production as soon as possible, but no later than January 1, 2030.¹⁶⁸

The declaration also called for equitable mechanisms to aid in distributing transition costs to include establishing an international fund for developing countries.¹⁶⁹ Notably, the resolution is not binding, but it does serve as a consensus basis for domestic action for each delegate.¹⁷⁰ Clearly, it proved influential at the June 1990 meeting.

162. *Call for Stronger Ozone Protection*, 135 SCI. NEWS 367 (1989).

163. *Nations Back Tougher CFC Measures but Decline to Set Up Climate Fund*, 20 Env't Rep. (BNA) 121 (May 12, 1989).

164. *See Montreal Protocol: Discussion on Adjustments and Amendments*, 20 ENVTL. POL'Y & L. 75 (1990).

165. *Lawmakers from Around World Sign Declaration on Global Environment*, Daily Rep. for Exec. (BNA) No. 86, at A-11 (May 3, 1990). This conference set a precedent for international negotiations on the global environment. *Id.* The delegates established strategies for legislative action in seven areas: global climate change, ozone depletion, population growth, deforestation and desertification, oceans and water resources, sustainable development, and the preservation of biodiversity. *Id.*

166. Declaration of Environmental Interdependence, *reprinted in* 20 ENVTL. POL'Y & L. 112, 117 [hereinafter Environmental Interdependence].

167. More stringent limits apply to substances with atmospheric lifetimes that exceed two years or contribute significantly to other environmental problems. *Id.*

168. INTERPARLIAMENTARY CONFERENCE ON THE GLOBAL ENVIRONMENT, 136 CONG. REC. S11,139 (July 31, 1990) (report by Senator John H. Chafee of R.I.); *see also* STAFF OF HOUSE COMM. ON ENERGY AND COMMERCE, 101ST CONG. 2D SESS., REPORT ON THE INTERPARLIAMENTARY CONFERENCE ON THE GLOBAL ENVIRONMENT (Comm. Print W, 1990). In addition to this plan, the declaration urged nations to move faster, if possible. 136 CONG. REC. at S11,139. Chafee praised Germany, the EC, Canada, and the Nordic countries for having already adopted this philosophy. *Id.*

169. *See* Environmental Interdependence, *supra* note 166.

170. *International Parliamentarians Discuss Environment*, 20 ENVTL. POL'Y & L. 87, 88 (1990).

Domestically, the United States took steps to align its national policy with the proposed protocol changes. On April 3, 1990, the United States Senate approved a revision to the Clean Air Act that added a new title to the law—Stratospheric Ozone Protection.¹⁷¹ This title contained seven elements that addressed a more aggressive and comprehensive schedule, required action by the EPA, and approved the use of trade sanctions for enforcement. First, the title declared it to be a national policy that ozone depleters should be eliminated “as expeditiously as possible.”¹⁷² Second, the EPA was to implement a more aggressive phase-out schedule than described in the bill if circumstances mandated.¹⁷³ Third, the bill placed CFCs on a ban schedule that mirrored the original Montreal Protocol but added an additional requirement—elimination no later than 2000.¹⁷⁴ Fourth, this legislation placed halons and CCl₄ on the same phase-out schedule as the most harmful CFCs.¹⁷⁵ Fifth, under the provisions of this title, methyl chloroform’s production was to be reduced 50 percent by 1996, with a total ban by 2000.¹⁷⁶ Also, HCFC production was to be frozen in 2015 at year 2014 levels, with new production prohibited by 2030.¹⁷⁷ Sixth, supplementary to the production phase-out, the bill provided for enacting regulations to achieve immediate and significant reductions in ozone depleters.¹⁷⁸ And seventh, the legislation included trade sanctions aimed at non-parties and those parties under U.S. jurisdiction that engaged

171. S. 1630, 101st Cong., 1st Sess. (1990); see *Clean Air Act Amended*, 20 ENVTL. POL’Y & L. 95 (1990).

172. *Id.*

173. The circumstances included: (1) information indicated it was required to protect human health and the environment; (2) availability of substitutes made acceleration of the schedule attainable; or (3) modification of the Montreal Protocol resulted in a more aggressive schedule. *Id.* The first circumstance was modeled after the authority granted under § 157(b) of the Clean Air Act. This section authorized the EPA Administrator to issue “regulations for the control of any substance, practice, process, or activity . . . which in his judgment may reasonably be anticipated to affect the stratosphere, especially ozone in the stratosphere, if such effect . . . may reasonably be anticipated to endanger public health or welfare.” Clean Air Act § 157(b), 42 U.S.C. § 7457(b) (1988) (repealed 1990). Rules promulgated by the EPA codify the minimum requirements for implementing the Montreal Protocol domestically. See EPA, Protection of Stratospheric Ozone, 40 C.F.R. pt. 82 (1989).

174. *Clean Air Act Amended*, *supra* note 171.

175. *Id.* This provision is stricter than the original protocol, which only required a freeze on halon production and did not identify CCl₄ as a depleter.

176. *Id.*

177. *Id.* The following uses would still be allowed after 2015: (1) maintenance and servicing of household appliances, commercial refrigeration units, and air conditioning units manufactured before 2015; (2) recycling; and (3) use as feedstocks for other chemicals. *Id.* After 2030, the title limits the allowable uses to recycling and feedstocks; however, recycled and existing stocks could be used to maintain and service items manufactured prior to 2015. *Id.*

178. *Id.* This would be achieved by having the EPA promulgate recapture and recycling regulations that would prohibit the venting of depleters from air conditioning and refrigeration units by January 1, 1992. *Id.* The EPA would also have to promulgate safe disposal regulations by January 1, 1994, placing statutory limitations and controls on motor vehicle air conditioning systems and nonessential consumer products containing CFCs (for example, party streamers and noise horns). *Id.*

in antiprotocol activities.¹⁷⁹ Additionally, the bill authorized the President to prohibit imports made with, but not containing, the controlled substances.¹⁸⁰

Similarly, the House responded to the need for more stringent controls. On May 23, 1990, the House passed its version of a clean air bill after only one day of floor debate.¹⁸¹ This bill, coupled with the Senate's legislation, exemplified the United States' commitment to strengthening a weak protocol.

IV. The New Protocol's Impact

Although the original protocol initiated considerable change in both the government's and industry's philosophy on ozone protection, the adoption process was somewhat protracted. The new protocol will not tolerate procrastination. In answer to this need, pre-June 1990 legislative and industrial actions are being enforced and implemented. At the same time, the focus is on future controls and necessary changes.

A. GOVERNMENT ACTION

1. Domestic Response

a. First Legal Action

Any doubt as to industry accountability under the Montreal Protocol was erased as the June 1990 meeting came to a close. The Department of Justice and the EPA filed suits against five U.S. companies alleging violations of the protocol and the Clean Air Act.¹⁸² Authority for initiating these suits was grounded in an EPA regulation that restricts production and consumption of CFCs by requiring producers and importers to obtain allowances from the agency.¹⁸³ All the com-

179. *Id.* Anti-protocol activities include transferring controlled substance technology to nonparties or investing in a nonparty's facilities to produce or expand the use of these substances. *Id.* Further, after 2000, a country desiring to trade must implement controls no less stringent than those in effect in the United States. *Id.*

180. *Id.*

181. H.R. 3030, 101st Cong., 2d Sess. (1990); see *Overview*, 20 *Env'tl. L. Rep.* (Env'tl. L. Inst.) 10397 (Sept. 1990). The bill closely resembled the Senate's proposals, yet the bills conflicted on two points. First, the House proposed an HCFC ban no later than 2030, five years later than the Senate's legislation. *Id.* Second, the Senate's operating permit proposal allowed companies to make minor deviations in manufacturing processes without triggering a permit review. *Id.* Further, the Senate's version granted the EPA power to block permits, which many House members and industry representatives viewed as an EPA veto. *Id.*

182. *Five Companies Sued by Justice, EPA Over Violations of Montreal Protocol on CFCs*, 21 *Env't Rep.* (BNA) 441 (July 6, 1990) [hereinafter *Five Companies Sued*]. These suits, filed June 29, 1990, were the first alleging these violations. The five companies sued were: Unitor Ships Service Inc., The BOC Group, Inc. [f/k/a Airco, Inc.], Fehr Brothers Inc., Oscar Hernandez Vinas, and Harris and Devoe Paints Corp. *Id.*

183. See 40 C.F.R. §§ 82.5-.6, .13 (1991); *Five Companies Sued*, *supra* note 182. The number of available allowances are limited in a twelve-month period with new allotments given as the period expires. *Id.*

panies were charged with importing CFCs into the United States without obtaining the mandatory consumption allowance, and some were found in violation of the rule's reporting requirements.¹⁸⁴ One company quickly agreed to settle its cases when it realized that the potential civil penalties could cost millions of dollars, and by May 1991 consent decrees had been proposed in the other cases.¹⁸⁵ However, all companies are expected to comply by using one of the following available alternatives: export extra CFCs to a company in another signatory country with more allowances, procure allowances from American companies, or transform the CFCs into another chemical.¹⁸⁶ The EPA optimistically states that despite these particular violations, the United States and a majority of its companies are in compliance with the protocol.¹⁸⁷ Clearly these suits signal the seriousness the United States places on its obligations under the Montreal Protocol and on ensuring continued compliance.¹⁸⁸

b. Clean Air Legislation

Further evidence of seriousness is federal legislative action. Discussion and debate over proposed clean air legislation began shortly after the June 1990 protocol meeting.¹⁸⁹ Prior to the House and Senate conference, hearings drew forth expressions of caution in enacting any legislation leading to unilateral action.¹⁹⁰ The CFC alliance director, Kevin Fay, urged the need for both the

184. *Id.*

185. Fehr Brothers Inc., who illegally imported 432,102 pounds of CFC-113 without a permit, settled immediately. *First Ozone-Protection Suits Filed by U.S.*, L.A. TIMES, June 30, 1990, at D1 [hereinafter *First Suits*]. The company agreed to pay a \$101,935 penalty with a promise to comply with the EPA rules. *Id.* Another settling company, Unitor Ships Service Inc., must pay \$23,635 in settlement of claims for their violation. See Lodging of Consent Decree Pursuant to CERCLA, 56 Fed. Reg. 4,300 (1991). Unitor's president had expressed his willingness to settle since they did not have "the resources to fight the government." *First Suits, supra*. Both companies realized a court's authority to impose civil penalties of up to \$25,000 for each violation, coupled with injunctive relief. See *Five Companies Sued, supra* note 182. The remaining three companies will be penalized according to recent Department of Justice notices. See Consent Judgment in Action to Enjoin Violation of the Clean Air Act; Oscar Hernandez Vinas, 56 Fed. Reg. 14,390 (1991); Harris & Devoe Paints Corp., 56 Fed. Reg. 14,389 (1991); The BOC Group, Inc., 56 Fed. Reg. 4,300 (1991).

186. *Five Companies Sued, supra* note 182. The last alternative, transformation into another chemical, has not been a chosen avenue for compliance. *Id.* Ideally, this form of compliance is the most preferable since it would reduce overall CFC use and not simply reallocate it.

187. *First Suits, supra* note 185.

188. Upon announcing the action, William Reilly asserted "we are taking action as a measure of our seriousness." *Id.* This attitude is also evident in a statement by Richard Stewart, an EPA attorney, who noted "this is a priority, so there may well be more." *Id.*

189. The first House-Senate clean air conference meeting was held July 13, 1990. *Overview, supra* note 181. By convening after the protocol meeting, the conferees were aware of the maximum allowable dates for phase-out.

190. Hearings were held before two House Science, Space and Technology subcommittees. The hearings' purpose was twofold: (1) to explore method development for transferring CFC-reducing technologies to developing countries, and (2) to anticipate the international market for CFC replacements and the corresponding role of U.S. companies in this potential market. *Congress Urged to Avoid Duplication in CFC Regs*, 238 Chem. Mktg. Rpt. (Info. Access Co.) No. 3, at 5 (July 16, 1990) [hereinafter *CFC Regs*].

United States and other industrialized nations “to create and maintain a stable regulatory environment that [would] facilitate the development of the needed new technologies” and allow the protocol to work effectively.¹⁹¹ Fay cautioned Congress on making changes in the international regulatory framework without basing them on new and compelling scientific information.¹⁹² “Frequent changes in the regulatory goals only serve to create greater confusion and economic chaos.”¹⁹³ Further cautionary statements came from the president of Halogenated Solvents Industry Alliance, who suggested avoiding a clean air bill addressing ozone depleters since the protocol would become U.S. law upon ratification.¹⁹⁴ In sum, industry feared any that unilateral action would dilute the amended protocol’s global effect and U.S. industry will suffer economically to other countries’ benefit.¹⁹⁵

Whether Congress heeded the warnings not to take unilateral action when it conferred on the Clean Air Act provisions is debatable. The final agreement on stratospheric ozone depletion resembles the Senate’s version except that the conferees compromised on methyl chloroform phase-out.¹⁹⁶ Instead of the 2000 or 2005 dates sought by the Senate and the House, respectively, methyl chloroform will be prohibited by 2002.¹⁹⁷ While this agreement does not require a

191. *Id.* Fay described the protocol as striking the “proper balance towards achieving the rapid phaseout” of CFCs and insisted that technology transfer would occur under its provisions. *Id.*

192. *Id.*

193. *Id.* (statement by Fay in urging adherence to the protocol’s regulatory goals, which are based on sound scientific, economic, and technological analysis).

194. *Id.* Dr. Paul Cammer asserted:

There is no reason for Congress to be considering unnecessary legislation that at best would duplicate the expanded Montreal Protocol, and at worse could hinder the ability of the United States to phase out CFC use and subject U.S. companies to product controls and regulations more stringent than those imposed on foreign competitors.

Id. Notably, both the House and Senate bills provide for more aggressive phase-out schedules than the amended protocol. See *supra* notes 171-81 and accompanying text.

195. See S. EXEC. REP. NO. 14, 100th Cong., 2d Sess. 19 (1988). Former EPA administrator Lee Thomas noted that “when the United States takes action, everybody else lays back, and they have all the incentives not to take action. They use the U.S. action as an excuse.” *Id.* As for the economic impact, if tighter restrictions are placed on methyl chloroform and HCFCs, U.S. electronic and aerospace companies will be deprived of products that their foreign competitors can use as substitutes. See *CFC Regs*, *supra* note 190 (statement by Cammer). This, in turn, can lead to the export of jobs overseas. *Id.* But see Wexler, *supra* note 130, at 17-18 (advocates unilateral action regardless of economic impact).

196. See *Clean Air Conferees Agree on Phase-Out of CFCs, Other Ozone-Depleting Compounds*, Daily Rep. for Exec. (BNA) No. 151, at A-10 (Aug. 6, 1990) [hereinafter *Clean Air Conferees*]. All of the Clean Air Act amendments were passed on October 27, 1990. Clean Air Act Amendments of 1990, 42 U.S.C.S. § 7671-7671q (Law Co-op Supp. 1991). See generally *Conference Agreement on Clean Air Comprehensively Revises U.S. Air Law*, BNA Wash. Insider (BNA) (Nov. 2, 1990), available in LEXIS, Nexis Library, Curmt File [hereinafter *U.S. Air Law*] (amendments touching every aspect of air pollution law passed); Michael D. Lemonick, *The Revised Clean Air Act Is Costly But Well Worth the Price*, TIME, Nov. 5, 1990, at 33 (discussion on the impact of the new clean air legislation).

197. 42 U.S.C.S. § 7671c(b); see also *Conferees Agree on Ozone Plan—Faster Timetable Set for Chemical Phase-Out*, WASH. POST, Aug. 4, 1990, at A4 [hereinafter *Conferees Agree*]. The 2002 date is contingent upon the availability of substitutes for essential uses. 42 U.S.C.S. § 7671c(d). Notably, this date is three years earlier than the amended protocol’s schedule for methyl chloroform.

CFC, halon, and CCl₄ ban earlier than the year 2000, it does require greater annual incremental reductions prior to the total ban.¹⁹⁸ Further, where the amended protocol is silent on HCFC phase-out, the agreement requires a restricted production ban by 2015 with total elimination by 2030.¹⁹⁹ Clearly this is the type of unilateral action feared by industry lobbyists, yet sanctioned by environmentalists.²⁰⁰ To effectuate the agreement's goals and provide guidelines to industry, the legislation charges the EPA with specific tasks. The EPA must issue regulations on safe use, recycling, and disposal, along with rules establishing criteria for development of safe alternatives.²⁰¹

The only significant disagreement in the conference centered on preemption of state CFC control programs.²⁰² Some conferees argued that preemption would set a dangerous precedent since environmental issues were not global or national in nature, but the cumulative result of numerous individual decisions.²⁰³ Supporters of preemption asserted that ozone depletion was a global issue and any action by state or local governments would be inappropriate.²⁰⁴ Despite arguments against preemption, the conferees adopted the House version, thereby prohibiting state or local governments from enforcing control programs until 1992.²⁰⁵

2. International Response

From an international perspective, the amended protocol has been widely embraced. Confirmations of commitment to the protocol's goals along with positive steps towards achieving them provide an optimistic view of its future.²⁰⁶

198. 42 U.S.C.S. § 7671c(b); see also *Conferees Agree*, *supra* note 197.

199. 42 U.S.C.S. § 7671d(a)-(b); see *supra* note 177 (identifying limited allowable uses).

200. After the agreement was announced, Fay asserted the desire for a reasonable time frame to ensure the projected \$10 billion, ten-year investment in substitutes is money well spent. *Conferees Agree*, *supra* note 197. Conversely, environmentalists argue the necessity of specific phase-out guidelines for substitutes as a control on industry to stop HCFC production and prevent worldwide adoption of them. *Id.*

201. 42 U.S.C.S. § 7671g, 7671k. The EPA must ensure timely and effective implementation of its provisions to avoid attack. See generally Doniger & Wirth, *Cooling the Chemical Summer: A Call for Action*, AMICUS J., Fall 1986, at 13-15 (NRDC sues EPA for failing to make a timely implementation of section 157(b)); *Lawsuit Seeks Full U.S. Phase-Out of Ozone-Depleting Chemicals*, NRDC NEWSLINE, Nov./Dec. 1988, at 4 (NRDC challenges the EPA's regulations on grounds of their ineffectiveness in stopping ozone depletion). See also *U.S. Air Law*, *supra* note 196.

202. *Clean Air Conferees*, *supra* note 196.

203. *Id.* (statement by Sen. George Mitchell [D-Me.] in opposition of preemption).

204. *Id.* (statement by Rep. W. J. Tauzin [D-La.] in support of preemption).

205. *Id.* California's controversial "Big Green" Initiative (Proposition 128) will not be challenged on preemption grounds due to its defeat in the November 1990 elections. This was one of the most far-reaching environmental proposals ever put forth in the United States. See generally Ken Sternberg, *Industry Future in the Ballot*, CHEM. WK., Sept. 19, 1990, at 24 (discussion on the environmental proposition and its potential impact). One of Proposition 128's measures called for a 1997 ban on all ozone depleters, three years before the earliest phase-out under the amended protocol. *Id.*

206. At the Economic Summit Meeting held July 11, 1990, leaders of the Group of Seven industrialized nations declared they "welcome[d] the amendment" and "urge[d] all parties to ratify the amended protocol as quickly as possible." *Industrialized Nations Decline to Commit to Concrete Steps to Curb CO₂*, 13 Int'l Env't Rep. (BNA) No. 8, at 321 (Aug. 8, 1990).

For example, Malaysia has embarked on an energetic campaign to reduce its dependency on CFCs.²⁰⁷ Active measures such as establishing a Protection of the Ozone Layer Committee, banning CFC and halon imports from nonsignatory countries, and negotiating bilateral agreements for the transfer of technology with transnationals are exemplary for a developing country such as Malaysia.²⁰⁸ Other countries are opting for a more aggressive phase-out schedule.²⁰⁹ Prior to Germany's reunification, East Germany had adopted West Germany's plan to ban the use of most CFCs by 1995.²¹⁰ At that time, it was unknown whether and to what extent East Germany would rely on HCFCs in implementing this ban.²¹¹ Another approach for ensuring the protocol's success was recently announced by Japan. The Ministry of International Trade and Industry will provide financial help to affected industries in an effort to encourage recycling and reuse.²¹² Conversely, the EC is considering an anti-industry approach by proposing an EC-wide charge or tax on CFCs.²¹³ All these measures indicate a global commitment to the amended protocol.

B. INDUSTRY'S RESPONSE

Perhaps even more vital than cohesive government action for the Montreal Protocol's success is industry support. Arguably, industry has no choice in the matter since the phase-out schedule is mandatory. Fortunately, industry has initiated much of the current action despite deterrents such as high costs and the fact that a relied-upon substitute, HCFC, is targeted for ban also.

207. See P. Prashanth, *Environment: Malaysia Moves to Cut CFC Use*, INTER PRESS SERV., July 23, 1990, available in LEXIS, Nexis Library, Currnt File. Although Malaysia's consumption of 4,000 tons appears small in comparison with total world consumption, it is significant when viewed regionally. *Id.* Malaysia is the third largest producer of semiconductors and one of the largest exporters of air-conditioners and refrigerators. *Id.*

208. *Id.* The committee makes recommendations on how to reduce and freeze CFC consumption and how to promote the use of substitutes. *Id.*

209. These countries are not parties to the separate agreement to phase-out CFCs by 1997. See *supra* note 95.

210. *Country Will Comply with CFC Ordinance of West Germany, Seeks Smaller CO₂ Cut*, 13 Int'l Env't Rep. (BNA) No. 7, at 288 (July 11, 1990). The only three CFC-producing companies in both West and East Germany had either agreed or been ordered to stop production by 1995. *Id.* Prior to this deadline, East Germany had sought to convert all spray doses of CFCs to a gas butane propellant, with the exception of medical uses. *Id.*

211. The East German Environment Minister, Karl-Hermann Steinberg, had stated the need for more scientific data before committing to a position. *Id.* Yet now that Germany is unified, an early phase-out of HCFCs may have become the prevailing view. Before reunification, West Germany required a ban on HCFC-22 by 2000. *Id.*

212. *Ozone Action by Japan*, N.Y. Times, July, 6, 1990, § D, at 2. The financial aid will be in the form of low-interest loans and tax incentives. *Id.*

213. Charles Clover & Boris Johnson, *Britain to Resist "Green" Taxes*, DAILY TELEGRAPH, Sept. 22, 1990, at 4, available in LEXIS, Nexis Library, Currnt File. The EC believes this tax will help achieve the protocol's targets. *Id.* Arguably, implementation of tax programs only serve to siphon capital from industries that are struggling to develop new technologies in order to comply. See *CFC Regs*, *supra* note 190 (CFC Alliance director's view of tax programs aimed at deterring CFC use and production).

1. Availability

When the original protocol was signed, industry complained of its unfairness. A year later, DuPont took measures that were very proactive in light of the original protocol. The company announced its plans for a total ban of CFC production by the close of the century.²¹⁴ This went far beyond a protocol that only required a 50 percent reduction upon reaching 2000. After uncertainties over pending federal legislation, unresolved international agreements, and the toxicity of potential alternatives were dispelled, other major producers joined DuPont.²¹⁵ Both Allied Signal, Inc. and Imperial Chemical Industries (ICI) have committed to invest in production facilities for new substitutes.²¹⁶

DuPont's plan is the most comprehensive, calling for the construction of four HFC plants that will be operating between 1992 and 1995.²¹⁷ This plan is only a start in fulfilling a world demand estimated at one million tons per year and an American market estimated at 300,000 tons.²¹⁸ Yet, these plants could satisfy most world needs for HFC refrigeration through the year 2000.²¹⁹ The other two manufacturers' plans do not appear as ambitious, but given the relative sizes of the corporations they are commendable. Allied Signal will open a plant by 1991 devoted to substitutes for blowing agents in urethane foam and cleaning solvents.²²⁰ ICI forecasts two facilities for producing substitutes by 1993.²²¹ Based on these aggressive acts, it appears CFC producers are racing to see who will be the last to produce this noxious chemical.

Although the search for alternatives is competitive, the chemical industry recognizes the need for unity in attacking the issue. Industry has launched two

214. Robert Goetz, *Chemical Producers Moving Toward CFC Substitutes*, INVESTOR'S DAILY, July 5, 1990, at 27. Some believe DuPont's decision to ban was partially motivated by fear of possible litigation arising from personal injuries attributed to ozone loss. *Setting the Rules*, ECONOMIST, Sept. 8, 1990, at 20.

215. Goetz, *supra* note 214. Several companies had already expended hundreds of millions of dollars on research and product development, either individually or cooperatively, but they put all plans on hold until positive test results were received. *Id.* Initial test results from the Program for Alternative Fluorocarbon Toxicity Testing (PAFT), an international consortium of chemical companies, provided the requisite security. *Id.*

216. Allied Signal, Inc. is a U.S. Corporation, while ICI is a British corporation.

217. *DuPont Announces Investments in Four Hydrofluorocarbon Plants*, INT'L PETROCHEMICAL REP., June 28, 1990, at 8 [hereinafter *Four HCFC Plants*]. Two of the plants will be located in the United States, one in the Netherlands and one in Japan. *Id.* One of the two U.S. plants has already completed construction. The Corpus Christi facility is the first commercial plant to produce HFC-134a, which is targeted to replace CFCs in automobile air conditioners and home refrigerators. *DuPont Completes Construction of Plant for CFC Alternative*, PR NEWSWIRE, Sept. 18, 1990, available in LEXIS, Nexis Library, Currnt File [hereinafter *DuPont Completes Construction*].

218. Goetz, *supra* note 214.

219. *DuPont Completes Construction*, *supra* note 217. Together, the HCFC production capability will be more than 140 million pounds per year. *Four HCFC Plants*, *supra* note 217.

220. Goetz, *supra* note 214. The company is also sinking \$250 million into the research and development of substitutes. *Id.*

221. *Id.* One plant will compete with DuPont in producing alternatives for refrigerants and air conditioners. *See id.*

initiatives focused on eliminating CFCs and analyzing alternatives. The first initiative, the Alternative Fluorocarbons Environmental Acceptability Study (AFEAS), examines and explores the environmental efficiency of such CFC alternatives as HCFCs and HFCs.²²² A subsequent initiative, PAFT, was created for the development of toxicological data on substitutes.²²³ Together, these two initiatives have expended \$60 million in analyzing all aspects of CFC alternatives, including their health and safety attributes.²²⁴ Yet another example of cooperation is the creation of a database, the Industry Cooperative for Ozone Layer Protection (ICOLP), designed to afford global access to information on alternative processes and technologies.²²⁵ Cooperative efforts such as these reduce not only the costs of changeover, but also the amount of time involved. Any effort in reducing time translates to the possibility of a ban even more aggressive than the amended protocol.

User cooperation in supporting the search for alternatives is also vital to a successful, if not early, phase-out. Already several industries have actively sought out and implemented alternatives. For example, the electronics industry has developed new cleaning agents from water, detergents, and even orange peels.²²⁶ Also, the refrigeration and air conditioning industries are reviving old coolants such as ammonia to replace CFCs.²²⁷ Even something as fundamental as water is a suggested alternative to halons used in fire suppression.²²⁸ The movement towards alternatives has been so great in some areas that demand for CFCs is actually less than the production limits set by the protocol.²²⁹ Unfortunately, some industries find their options limited. For example, pharmaceutical companies, who are not exempt from the protocol, must replace the CFC propellant in anti-asthma inhalers.²³⁰ Arguably, these inhalers contribute only 0.4 percent to overall CFC production, but the protocol does not discriminate.²³¹

222. *International Conference Sets Up Funds for CFC Phase-Out*, INT'L PETROCHEMICAL REP., July 5, 1990, at 3 [hereinafter *Phase-Out*]. AFEAS was formed in 1988 by sixteen major CFC producers. *Id.*

223. *Id.* As discussed *supra* note 215, PAFT provided the impetus to build substitute-producing plants. In all, fourteen chemical companies representing the United States, Europe, Japan, and South Korea have pooled their resources to test the safety of proposed substitutes. Jose Katigbak, *Race to Plug Hole in the Sky*, Reuters Libr. Rep. (Reuters) (Sept. 28, 1990), available in LEXIS, Nexis Library, Currnt File.

224. *Phase-Out*, *supra* note 222.

225. Katigbak, *supra* note 223.

226. David Doniger & Alan Miller, *Fighting Global Warming Is Good for Business*, N.Y. TIMES, Aug. 6, 1990, § A, at 13.

227. *Id.*

228. The deputy assistant secretary of the U.S. Air Force posed the water alternative at the Singapore-U.S. Seminar on Chlorofluorocarbons held in September 1990. See Katigbak, *supra* note 223.

229. *Fluorocarbons Remain Strong*, CHEM. WK., Aug. 29, 1990, at 46.

230. Michael M. Phillips, *Three N.J. Drug Firms Join to Test CFC Substitute*, STATES NEWS SERV., Sept. 24, 1990, available in LEXIS, Nexis Library, Currnt File. This dilemma created another consortium, the International Pharmaceutical Aerosol Consortium for Toxicology Testing (IPACT), whose current mission is testing HFC-134a's toxicology. *Id.*

231. *See id.*

Undoubtedly, one key incentive for U.S. users to make a changeover is the CFC user tax, which is more costly than the prices of CFC products themselves.²³²

2. Costs

Vast expenditures in search of substitutes and potential costs in incorporating them into products is unsettling to industry. Recently, the Department of Energy estimated that a ban by the year 2000 would cost between \$19 and \$30 billion in equipment write-offs.²³³ Moreover, industry hesitates to make large capital expenditures such as DuPont's \$1 billion investment over the next ten years. "The risks involved in this investment are horrendous. We are going out with a product which is less efficient . . . , costs five times as much, and the only reason is because of the environmental imperative. We've never been in a market quite like it before."²³⁴ However, industry analysts discount the effect on revenues and earnings and maintain the investment is relative.²³⁵ For example, DuPont's CFC sales represent \$750 million compared to the company's total revenue of \$35.5 billion.²³⁶ Although the investment outlay seems enormous, if looked at in perspective it is not prohibitive.

Indeed, the outlook is optimistic. As alternatives develop, the once-forecasted costs are declining fast. The EPA had predicted an expense of \$3 billion over ten years to meet the original protocol's 50 percent reduction.²³⁷ But one year later, the total costs were recalculated as less for doing twice as much under a total ban.²³⁸ Moreover, new cooling compounds and equipment offer a potential energy savings reaching \$5 billion in this decade and \$100 billion over the next eighty-five years.²³⁹ Further, as added incentive, health and environmental damages amounting to \$30 trillion are avoidable.²⁴⁰

Affirmative action by producers and users can also keep replacement costs down. One option is to use existing stock frugally.²⁴¹ Recycling is another possible solution; however, extraction of CFCs may prove costly and inefficient. Nevertheless, DuPont has implemented a recycling program for CFC-11 and CFC-12.²⁴² The United States has sought to encourage such programs by ex-

232. *Fluorocarbons Remain Strong*, *supra* note 229. The \$5 billion dollar tax is imposed on both producers and users and operates as an incentive for new investments in non-CFC technologies. See Doniger & Miller, *supra* note 226.

233. *The Costs of Saving the Ozone Layer—Choose Your Shade of Green*, *ECONOMIST*, Apr. 14, 1990, at 74 [hereinafter *Shade of Green*].

234. *Setting the Rules*, *supra* note 214, at 23 (statement by an ICI manager).

235. See Goetz, *supra* note 214. Further, in 1989 alone, DuPont invested almost \$1.4 billion in research and development as compared to a \$240 million investment in CFC alternatives. *Id.*

236. *Id.*

237. Doniger & Miller, *supra* note 226.

238. *Id.*

239. *Id.*

240. *Id.*

241. See *Shade of Green*, *supra* note 233.

242. *Id.* DuPont will ship containers anywhere in the United States to collect a minimum of 500 pounds. *Id.* Currently, companies have no real incentive to recycle since recycling operations are not

emptying recycled CFCs from the \$1.37 per pound tax levied on new CFCs.²⁴³ Europeans are also joining in the effort by pooling their resources to offset recycling costs. A German and British coalition will extract CFCs from foam and compressors at a cost of around \$29 per extraction.²⁴⁴ More companies may join this effort once they are convinced that such programs can make a profit.

Finally, another affirmative step is rationalization. If the original protocol's restriction on rationalization between countries is lifted under the new accord, European countries stand to benefit.²⁴⁵ As 1995 draws near and a 50 percent reduction is mandated, companies must regroup to ensure efficient operations. Rationalization will effectuate this goal along with reducing emissions and keeping CFC prices at acceptable levels.²⁴⁶ However, even if the amended protocol permits rationalization by EC countries, their own competition laws may not. The existence of relatively few players who affect the availability of CFCs, along with the development of new alternatives, may block European efforts to rationalize.²⁴⁷

3. Impact on Consumers

Ultimately, the consumer sees the product of industry's efforts to find substitutes and reduce CFC emissions. More importantly, it is the consumer who will bear the costs and inconvenience of this transformation. But, viewed in the broad perspective, the overall benefit to health exceeds these negatives. By the end of 1990 familiar sights such as disposable food service and packaging items (McDonald's clamshell packages) and supermarket meat trays manufactured with CFCs disappeared.²⁴⁸ Automobiles without CFC air conditioning systems are scheduled for release in the 1994 model year, and home refrigeration and air

profitable. *Id.* Moreover, the EPA recently issued new regulations that subject used or recycled CFCs to the same export controls that apply to new products. 55 Fed. Reg. 24490 (1990). See also *Used, Recycled CFCs Subject to Control Under Amendment to Montreal Protocol Rules*, 21 Env't Rep. (BNA) 373 (June 22, 1990) [hereinafter *Used, Recycled CFCs*].

243. *Shade of Green*, *supra* note 233.

244. *Id.*

245. See *supra* note 122 and accompanying text. Currently, nine companies produce CFCs in seven European countries, while the United States and Japan each have five producers. Emma Chynoweth, *European CFC Makers Set to Rationalize as Ban Is Lifted*, CHEM. WK., July 18, 1990, at 10.

246. Chynoweth, *supra* note 245.

247. *Id.*

248. See Goetz, *supra* note 214. In the first half of 1990 manufacturers of plastic foam products for food packaging announced the voluntary elimination of fully halogenated CFCs from their polystyrene foam production process. *Good News: Help for the Ozone Layer*, FOOD PACKAGING, June 1990, at 54. Unfortunately, 25 percent of the foam products are currently made with HCFCs, which still has some ozone-destroying power. John Javna, *What's an HCFC?*, SAN FRANCISCO CHRON., Oct. 14, 1990, at 18. According to the president of the Food Packaging Institute, HCFCs are targeted for elimination within a few years. *Id.* McDonalds responded to criticism by eliminating the use of any foam-plastic sandwich boxes. Instead, the company has converted to paper wrap or cardboard boxes. This policy, however, only applies to U.S. restaurants; overseas packaging changes will be decided separately. Martha T. Moore, *McDonalds Trashes Sandwich Boxes—Company Yields to Customers*, USA TODAY, Nov. 2, 1990, at 9B.

conditioning industries will convert towards the decade's end.²⁴⁹ Others, such as the refrigeration industry, are moving more slowly. This slower evolution is attributed to the loss in energy efficiency in non-CFC units. Either the refrigerators must be larger in size or less energy efficient.²⁵⁰ However, engineers have had recent design successes. As a joint effort, Sanyo and Dow Chemical produced a commercially available refrigerator featuring a 40 percent reduction in CFC-11 while retaining desirable insulation and performance properties.²⁵¹ Granted this product does not meet the total ban criteria, but it does provide optimism for similar future successes. The adaptation required of consumers is trivial as against that of industry, but more important as compared to the potential harm to health.

V. A Question of Adequacy

Although the Montreal Protocol was clearly strengthened, whether it will help to eliminate the ozone hole is questionable. Over time, the new control measures, commitment from developing countries to ratify, commitment to provide aid to developing countries, and overall enforceability, both internationally and domestically, may prove adequate. Yet, the converse is also true. The protocol will continually be challenged on all these fronts, and whether it will retain its flexibility remains to be seen.

A. CONTROL MEASURES

As amended, the Montreal Protocol is a much stronger commitment than the original protocol to resolving an important international problem—ozone depletion. Despite this strengthening, some critics maintain the new protocol is still inadequate. Joe Farman, the head of Atmospheric Dynamics at the British Antarctic Survey, criticizes the target dates for phase-out as being too distant.²⁵² "They don't seem to have really grasped the point that once you have made up your mind to do something about ozone depletion you are very much better off if you get the major part of it done quickly . . ."²⁵³ Farman also believes that insufficient attention was given to the dangers of alternatives and the need for recycling the controlled substances.²⁵⁴ Not surprisingly, two environmental groups, Greenpeace and Friends of the Earth, also criticized the agreement for

249. *Id.*

250. See *Shade of Green*, *supra* note 233.

251. *Dow/Sanyo Freeze Out CFC-11*, CHEM. WK., Oct. 17, 1990, at 37.

252. John Brice, *Critics Say New Ozone Agreement Not Strong Enough*, CHRISTIAN SCI. MONITOR, July 2, 1990, at 3. Farman is the British scientist who discovered the hole in the ozone layer.

253. David Nicholson-Lord, *Dates for Ozone Action "Too Late,"* INDEPENDENT, July 1, 1990, at 2 (comment by Joe Farman).

254. Brice, *supra* note 252.

not going far enough.²⁵⁵ According to scientists, the Antarctic ozone hole will still make its annual appearance during most of the 21st century.²⁵⁶ Just as startling are estimates of a 20 to 30 percent ozone depletion in the northern hemisphere and the presence of ozone holes over Mediterranean countries.²⁵⁷ Pessimistic views such as these prompt critics to urge immediate phase-out. If such immediate phase-out is unrealistic, perhaps the 1997 phase-out adopted by thirteen countries in a separate declaration is acceptable.²⁵⁸

Despite the desire for a 1997 phase-out, the United States stood its ground. Worries over the capability of industry to develop safe alternatives prevented any earlier commitment. This stance was evident during the protocol negotiations and in the amendments to the Clean Air Act.²⁵⁹ However, the United States may be induced to alter its position. New, sound scientific data spotlighting the inadequacy of control measures may provide the incentive for more aggressive acts. Recently, an instrument was developed for the Network for the Detection of Stratospheric Change to provide a means for more accurate ozone loss detection.²⁶⁰ The network will consist of five stations located around the world to measure the rate and severity of ozone loss.²⁶¹ This method is more exact and mobile than satellites relied on in the past; therefore, the control measure's effectiveness is capable of accurate assessment.²⁶² If new data shows an even graver outlook, the parties could hold an emergency meeting to analyze the new data and decide whether a more rigorous timetable is necessary.²⁶³ As it stands now, the parties have agreed to reevaluate a possible 1997 phase-out at another conference in 1992.²⁶⁴

Any possibility of a faster phase-out schedule will hinge on industry's progress in developing safe alternatives. Industry is certainly moving quickly by planning for and constructing alternative-producing plants, but it is relying heavily on undesirable alternatives such as HCFCs and HFCs. The protocol parties already have agreed to ban HCFCs by 2040, and the Clean Air Act imposes an even

255. *Id.*

256. Tom Wilkie, *British Association for the Advancement of Science/ Science 90: Holes in Ozone Layer "Will Reach the Mediterranean,"* INDEPENDENT, Aug. 23, 1990, at 3.

257. *Id.* See *infra* notes 283-86 and accompanying text for more recent ozone depletion data.

258. See *supra* note 95.

259. As discussed *supra* note 173 and in the accompanying text, the adopted amendment predicates a more aggressive schedule on the availability of substitutes or any change in the protocol's schedule. However, the protocol is also predicated, at least implicitly, on the availability of substitutes.

260. Thomas Clavin, *Long Island Q&A: Dr. Philip Solomon—A Radio Astronomer Helps Track the Disappearance of Ozone*, N.Y. TIMES, Oct. 7, 1990, § 12 LI, at 2. The Network for the Detection of Stratospheric Change is a program financed by NASA. *Id.*

261. *Id.*

262. *Id.* The ground-based stations allow scientists to study different areas with accuracy, whereas a satellite is fixed in orbit and has more room for error in its calibrations. *Id.*

263. Article 11 provides for extraordinary meetings at such times as may be deemed necessary. See Montreal Protocol, *supra* note 1, art. 11(2), 26 I.L.M. at 1557.

264. See *supra* note 96.

earlier total ban, by 2030. Further, new scientific data could provide the impetus for a speed-up of this schedule. Granted, producers and users can temporarily rely on HCFCs and HFCs since they must attempt to satisfy current needs without CFCs. At the same time, industry must search for permanent, safe alternatives. Industry's ability to balance these two objectives will influence hesitant countries such as the United States on whether a faster schedule is technically and economically feasible.

Alternatives are available if a blanket ban by 1997 or earlier is not technically or economically feasible. First could be the imposition of an immediate ban on all nonessential uses. Although difficulties arise in defining "essential" and "nonessential," it is not impossible. Determinations of what an "essential" use is can be made under the permit system criteria used for the 1978 aerosol ban.²⁶⁵ This permit system determined essentiality based on the nonavailability of substitute products, economic consequences of removing the product from the market, the product's impact on health and the environment, and effects on the quality of life if the product were no longer available.²⁶⁶ The new Clean Air Act amendment partially recognizes this alternative by requiring statutory limitations and controls for nonessential consumer products containing CFCs.²⁶⁷

Other alternatives, mentioned earlier, are conservation of current stock and increased recycling efforts. Although the United States excludes recycled CFCs from taxation, recycling still has no profit incentive. Cash incentives to return nonfunctioning refrigerators and air conditioners to dealers for ultimate return to the manufacturers for CFC extraction and reuse would guarantee an immediate reduction in CFC release.²⁶⁸ Although these alternatives are not the measures called for by the critics, they do offer hope for lessened levels of CFCs without completely binding industry's hands.

B. THIRD WORLD RATIFICATION

The protocol provides an international solution to a global environmental issue. Consequently, every CFC-producing and -using country must ratify the agreement. Such ratification has not occurred. As of January 1991, India and China had still not agreed to ratify. Perhaps they are waiting for positive signs that technology transfer will occur. After all, action on technology transfer was their primary concern at the June 1990 meeting. Developed countries, especially the United States, promised that trade barriers would not hinder any technology transfer. Further, any fear that such transfer will not occur should not prevent either India or China from ratifying since an escape clause permits nonparticipation if access to proper technology is blocked.²⁶⁹

265. Ogden, *supra* note 18, at 1014 n.108.

266. *Id.*

267. 42 U.S.C.S. § 7671i; *see also Clean Air Act Amended, supra* note 171.

268. Noble-Alligire, *supra* note 106, at 289.

269. *See* Brice, *supra* note 252.

Availability of finances should not deter ratification either, although as discussed earlier, the Third World countries view the international fund as inadequate.²⁷⁰ Whether developed countries regard the suggested amount as the full allocation or only a beginning remains to be seen. In June 1990 the parties, by establishing the fund and its operation, did fulfill the requirement of article 13 of the protocol that they adopt financial rules.²⁷¹ Taken a step further, since article 13 expressly refers to "funds required for the operation of this protocol" the establishment of the fund may be viewed as only a partial fulfillment.²⁷² If and when additional funding is required, full cooperation will once again be necessary. As before, if the United States should balk at providing financial support, other industrialized nations and industry would probably exert their influence.²⁷³ Thus, the onus is on the developed nations to ensure the developing nations are satisfied. Only then will the necessary maximum ratification be obtainable.

C. INTERNATIONAL AND DOMESTIC ENFORCEABILITY

Even if maximum ratification is achieved, this international agreement will be ineffective if not enforced.²⁷⁴ Yet, the amended protocol does not identify institutional mechanisms for determining noncompliance and sanctions for such noncompliance.²⁷⁵ While the protocol does impose trade restrictions to enforce compliance, any compliance is still voluntary.²⁷⁶ Some experts suggest that further measures are unnecessary since market mechanisms will ensure compliance.²⁷⁷

The assumption is that the production of CFCs will become less economically attractive since the market will gradually adapt to alternative substances. Furthermore, the expectation is that trade controls will also make CFC production unattractive for countries not party to the protocol. For this reason, major shifts of CFC production facilities to the Third World are equally excluded.²⁷⁸

Sole reliance on market mechanisms and the current trade restrictions may not be enough. Some method of determining whether a violation has occurred²⁷⁹ and

270. See *supra* notes 85-86 and accompanying text.

271. See Montreal Protocol, *supra* note 1, art. 11(3), 26 I.L.M. at 1557-58.

272. *Id.* art. 13, 26 I.L.M. at 1559.

273. Pressure from British Prime Minister Margaret Thatcher and several U.S. industries forced President Bush to change his mind on supporting the original fund. See *Backing of Administration*, *supra* note 90. Industries wanted U.S. support due to fear of trade retaliation. *Id.*

274. See H. Christian Sorensen, Recent Developments, *International Agreements—Montreal Protocol on Substances That Deplete the Ozone Layer*, 29 HARV. INT'L L.J. 185, 190 (1988).

275. See Montreal Protocol, *supra* note 1, art. 8, 26 I.L.M. at 1556. Under article 11 the parties were to consider and approve procedures and institutional mechanisms specified in article 8. *Id.* art. 11(3)(d), 26 I.L.M. at 1558.

276. See *id.* art. 4, 26 I.L.M. at 1554-55.

277. BRUNNÉE, *supra* note 111, at 251.

278. *Id.* at 251-52.

279. Under the Vienna Convention, acceptance of one of two forums is voluntary; therefore no mandatory means exists for resolving disputes over violations. Noble-Alligire, *supra* note 106, at 292. In the event of a dispute, the parties may either (1) declare themselves bound by arbitration; or

of administering appropriate penalties must be established. General political, economic, or other punitive sanctions in response to violations can be invoked, but a more effective means is favored since "specific provisions in an agreement permitting sanctions will legitimate their use, make it easier and less politically costly for nations to invoke them, and thus make the threat that they will be invoked more credible."²⁸⁰

From a national perspective, the United States has been the first to hold companies accountable under the protocol's restrictions. Moreover, aggressive legislative action through Clean Air Act reforms has taken place. With the promulgation of these new guidelines and the original power enabling the EPA to bring suits, internal policing appears under control. However, the power to police companies outside the United States does not. Like the protocol, the new Clean Air Act imposes trade sanctions on nonparties, thereby restricting U.S. trade of controlled substances to parties that are in compliance.²⁸¹ And, after the year 2000, the United States will only trade with countries that have a control program no less stringent than its own.²⁸² But the United States will not know which parties are or are not in compliance. Further, even if a country establishes controls equal to those of the United States, only that country, or worse yet the individual company will know whether the controls are enforced. Eventually, if not already, international law will be challenged with questions of how to enforce bans. Meanwhile, the parties must trust one another.

VI. Post-June 1990 Developments

A. NEW INFORMATION PROVIDES AN EVEN GREATER CHALLENGE

Again, the ink had scarcely dried before more scientific data revealed a picture even grimmer than that at the 1990 meeting. In April of 1991 EPA Administrator Reilly announced that the ozone shield is depleting twice as fast as previously calculated.²⁸³ The recent data suggest that "4 to 5 percent of the ozone layer over the United States had been destroyed in the past decade."²⁸⁴ The EPA now

(2) agree to submit the dispute to the International Court of Justice. Vienna Convention, *supra* note 111, art. 11, 26 I.L.M. 1534.

280. R. BILDER, *MANAGING THE RISKS OF INTERNATIONAL AGREEMENT* 180 (1981); *see also* Noble-Alligire, *supra* note 106, at 292-93 (discussion on noncompliance and accompanying sanctions to make parties comply).

281. *See Clean Air Act Amended*, *supra* note 171.

282. *Id.*

283. *Ozone Depletion Occurs Twice as Fast as Previously Thought*, *Reilly Reports*, 21 *Env't Rep.* (BNA) *Curr. Dev.* 2225 (Apr. 12, 1991) [hereinafter *Twice as Fast*]; *see also* William K. Stevens, *Summertime Harm to Shield of Ozone Detected Over U.S.*, *N.Y. TIMES*, Oct. 23, 1991, § 1, at 1 (international panel of scientists release report of damage to temperate zones).

284. *Twice as Fast*, *supra* note 283, at 2226. This finding is based on data from NASA's Total Ozone Measurement System, which employed satellites to monitor the amount of ultraviolet light reaching the ground from 1979 to 1990. *Id.* Scientists believe an unforeseen chemical reaction caused by accumulated chlorine in the atmosphere causes a greater depletion rate. *Id.* In addition, a separate study indicates methane, which also contributes to ozone depletion, has an atmospheric lifespan

estimates that approximately 200,000 more deaths from skin cancer may occur in the United States over the next fifty years.²⁸⁵ Yet, some scientists doubt the need for more immediate concern since this protective layer still performs its function in the summer months.²⁸⁶ Undeniably, if this new information is accurate, the June 1990 amendments are insufficient.

The new data will undoubtedly provoke additional movement to accelerate the ban of any ozone-depleting substances.²⁸⁷ According to Reilly, the policy implications are unavoidable.²⁸⁸ All policy options will be considered, which include accelerating the U.S. deadline for halting CFC production to coincide with the European Community's date of 1997, accelerating developing countries' current 2010 deadline, and placing more stringent controls on the less-ozone-depleting substitutes.²⁸⁹ As a more aggressive measure, environmentalists advocate adopting Germany's new ozone law, which bans CFCs by 1995.²⁹⁰

Caution, however, is being urged. Michael Deland, Chairman of the White House Council on Environmental Quality, states that "before we undertake a major overhaul of U.S. or world-wide policies, we need to very carefully scrutinize this and other reports to evaluate the accuracy in a deliberative and comprehensive scientific way."²⁹¹ In addition, China and India's recent announcement to join the protocol in 1992 must be considered.²⁹² Their decision was based upon the ten-year grace period afforded developing countries.²⁹³ If devel-

about 25 percent longer than previously thought. *Reilly Responds to NASA's Ozone Depletion Study*, PUB. UTIL. FORT., May 15, 1991, at 15 [hereinafter *Reilly Responds*]. Scientists have also discovered that ozone depletion may have a cooling effect, offsetting global warming. Stevens, *supra* note 283. Thus, in restoring the ozone layer, the global warming problem is exacerbated.

285. *Reilly Responds*, *supra* note 284. The EPA also projects that twelve million Americans, not 500,000 as previously estimated, will develop skin cancer over this same period of time. Robert Sullivan, *Under the Sun; The Ozone Layer is Vanishing Faster than Anyone Thought*, SPORTS ILLUSTRATED, Apr. 15, 1991, at 15.

286. See *Alarming Loss; Is the Ozone Layer Thinning Faster Than Expected?*, TIME, Apr. 15, 1991, at 55. While Robert Watson commends the study, he questions the EPA's skin cancer predictions. *Id.*

287. U.N. officials seek to reopen international discussions in 1992 in an attempt to further accelerate the phase-out schedule. Stevens, *supra* note 283.

288. *Twice as Fast*, *supra* note 283, at 2226.

289. William K. Stevens, *Keeping a Closer Eye on Global Ozone Gauge*, N.Y. TIMES, Apr. 7, 1991, § 4, at 7; see also *Twice as Fast*, *supra* note 283, at 2226 (Reilly states "[we] are exploring the full range of options open to us, including intensifying efforts to assist developing countries and accelerating efforts to bring ozone-safe substitutes on line"). DuPont has responded to the new scientific data by accelerating its phase-out of CFCs and halons by three to five years. Stevens, *supra* note 283.

290. *Environment: Ozone Depletion Occurring Twice as Fast as Previously Thought*, EPA's Reilly Says, Daily Rep. for Exec. (BNA) No. 67, at A-5 (Apr. 8, 1991) [hereinafter *Reilly Says*]. This law, adopted by the then-West German cabinet, also requires a ban of HCFC-22 in foam assembly applications by 1993 and in cooling operations by 2000. *Id.*

291. William K. Stevens, *Ozone Loss Over U.S. Is Found to Be Twice as Bad as Predicted*, N.Y. TIMES, Apr. 5, 1991, § A, at 1.

292. See Ni Bainan, *Environment: China-India Role in Montreal Protocol Pact Heats Up CFC Debate*, INTER PRESS SERV., June 28, 1991, available in LEXIS, Nexis Library, Currnt File.

293. See *id.*

oped countries attempt to impose a more aggressive schedule, these two major players may revoke their support. Because much of this new data came only months before the third meeting of the protocol parties in June 1991 in Nairobi, they were unable to act on it. They do, however, have time to deliberate on the implications of the data before the June 1992 meeting.

B. INTERNATIONAL FUND ISSUES

Within weeks of the EPA's announcement of its new findings, reports of problems with the international fund were publicized. Even though industrialized nations pledged funds, a majority of governments have not paid their portion of the \$54 million annual contribution.²⁹⁴ The result is delay in approval of proposals made by developing countries for conversion to safer substitutes. In response, the United States will propose that most project funding occur over the next ten years instead of the more protracted twenty-year span originally planned.²⁹⁵ Yet, if this proposal were to result in a retraction of the additional ten years given to developing countries under the protocol, conflicts will arise. According to Mostafa Tolba, if the additional ten-year grace period is taken away, the developing countries "will dig in their heels for sure and say no."²⁹⁶

Even if the money were readily available, most proposals presented to date have been criticized as vague and duplicative.²⁹⁷ Thus, the unprecedented international fund that served as an incentive to developing countries' ratification may now be a basis for obstinacy.²⁹⁸ Undoubtedly, the fund's executive committee has an immediate challenge in smoothing out two key processes, fund collection and project approval.

Unfortunately, the third meeting of the Montreal Protocol parties was less productive than those of previous years. The parties were apprised of NASA's most recent data, yet did nothing. Perhaps the intervening year prior to the June 1992 meeting will prove beneficial. The parties should have ample time to carefully develop and thoroughly discuss the additional control measures required. If they do, the June 1992 meeting may be the most significant of all.

294. *Ozone Aid for Third World Slow to Arrive*, L.A. TIMES, Apr. 15, 1991, at A1. Approximately \$3 million has been contributed, mostly from Nordic countries. *Id.* Further, as of March 1991, the United States had contributed only \$1 million of its \$13.5 million bill for 1991, which is one-fourth of the total fund. *Id.* By June 1991, however, total contributions of \$20 to \$30 million were expected. *Id.*

295. *Id.* (statement by Eileen Clausen, an EPA official who represents the United States on the fund's executive committee).

296. *Id.*

297. *See id.* In defense of inaction, a U.S. official states that because proposals developed by two U.N. agencies are vague and overlap, to pay now, without extensive revisions, is foolish. *Id.* Yet Eileen Clausen maintains that the World Bank's projects totaling \$3.5 million, which involve Mexico, Brazil, Tunisia, and Egypt, meet the funding criteria. *Id.*

298. Whether the current funding issues will cause India and China to rethink their positions and refuse to sign the protocol in 1992 remains to be seen.

VII. Conclusion

The Montreal Protocol has proven its responsiveness as a dynamic, flexible instrument that has adapted to evolving scientific data while retaining perspective on the accompanying economic and technical impacts of such change. As a consequence, the protocol's success as a framework for resolving global environmental issues has encouraged international negotiations on the larger concern of global climate change. Time will determine whether the same cooperation achieved in preserving the ozone layer is obtainable for other global environmental concerns.

