THE BLACK MARKET TRADE IN CHLOROFLUOROCARBONS: THE MONTREAL PROTOCOL MAKES BANNED REFRIGERANTS A HOT COMMODITY

*Frederick Poole Landers, Jr.**

I. INTRODUCTION

When the Montreal Protocol on Substances That Deplete the Ozone Layer[1] (hereinafter Montreal Protocol or Protocol) was signed by twenty four countries and the European Community in September of 1987, it was hailed as a milestone in international environmental diplomacy.[2] Designed to control the production and consumption of ozone-depleting chemicals, the Protocol provides for a gradual phase-out of chlorofluorocarbons (CFCs) before irreversible damage is done to the earth's ozone layer.[3] While the Protocol has been successful in its goal to wean industrialized countries from their dependence on CFCs and encourage the development of substitute products, it has also resulted in some unforeseen problems. Most industrialized nations had banned the production of CFCs by 1996, however, loopholes in the Montreal Protocol have led to the creation of an international black market trade in the banned substances. Because the agreement depends heavily upon a variety of market incentives and much cooperation among participating nations, this new black market is threatening the effectiveness of the treaty, and more importantly, the ecology of our planet. As further restrictions on the production and use of CFCs continue to be implemented under the Protocol, these banned refrigerants will become an increasingly hot commodity.

After a background discussion of the ozone crisis and events leading up to the Montreal Protocol, this Note will examine the Protocol itself and the

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[1] *Montreal Protocol on Substances That Deplete the Ozone Layer*, opened for signature Sept. 16, 1987, S. Treaty Doc. No. 100-10, reprinted in 26 I.L.M. 1550 (1987) (entered into force Jan. 1, 1989) [hereinafter Montreal Protocol].

[2] Ronald Reagan, statement, April 5, 1988, reprinted in President Signs Protocol on Ozone-Depletion Substances, *Department of State Bulletin*, June 1988.

[3] *Montreal Protocol*, *supra* note 1, art. 2.

progress made towards eliminating ozone-depleting substances. Subsequently, the Note will discuss the black market trade in CFCs and its effect upon the Protocol. In conclusion, the Note will provide an outline of the proposed solutions to the black market problem, and explain what steps must be taken if the Montreal Protocol is to remain an effective force in ozone layer protection.

II. OZONE DEPLETION: PAST, PRESENT, AND FUTURE

A. The Ozone Layer and Chloroflourocarbons

Approximately between six and thirty miles above the earth is an atmospheric layer of three-atom oxygen molecules. These molecules absorb ultraviolet (UV-B) rays from the sun which, if allowed to reach the earth in significant quantities, will cause severe damage to human, animal, and plant cells.[4] The amount of ozone in the stratosphere is the result of a balance between natural processes which create and destroy ozone.[5] Humans can only accelerate the destruction of ozone by introducing ozone depleting substances into the atmosphere.

Chloroflourocarbons were invented in the 1930s to replace the gases used in refrigerators such as ether vapor, ammonia, and sulfur dioxide—gases

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[4] *Human Health Effects of Ultraviolet-B Radiation: Hearings Before the Subcommittee on Earth and Environment of the House Committee on Science*, 102d Cong., 2d Sess. (1995) (testimony of Margaret L. Kripke, Professor and Chair, The University of Texas M.D. Anderson Cancer Center) [hereinafter Kripke Testimony]. Even a small increase in the amount of UV-B radiation present in sunlight is likely to have important consequences for plant and animal life on earth and will almost certainly jeopardize human health. In addition to causing basal, squamous, and melanoma cancers of the skin and damage to the eye in the form of cataracts, UV-B radiation has also been shown to reduce the body's immunity to infectious agents. *Id. See also Environmental Aspects of the Stratospheric Ozone Depletion* (paper presented by UNEP at the Meeting of Experts on the Ozone Layer, Washington, D.C., March 1977), reprinted in *The Ozone Layer* (A. Biswas ed. 1979) 1,2 [hereinafter Biswas]. Such increases in ultraviolet radiation can also have destructive consequences on terrestrial and aquatic plants. *See generally* Teremura, *Overview of Our Current State of Knowledge of UV Effects on Plants*, in 1 EFFECTS OF CHANGES IN STRATOSPHERIC OZONE AND GLOBAL CLIMATE 4, 165 (1986) [hereinafter Stratospheric Ozone]. Many species of phytoplankton, the beginning of the oceanic food chain, can also be severely damaged by ultraviolet radiation. Such damage could have serious implications for the world's food-supply as we increasingly depend upon the ocean's resources. *See generally* Worrest, *The Effect of Solar UV-B Radiation on Aquatic Systems: An Overview*, in STRATOSPHERIC OZONE, *id.* at 175.

[5] *See* Biswas, *supra* note 4, at 10-11.

which are chemically-reactive, dangerous to handle, and toxic to humans.[6] CFCs, on the other hand, are inert, nontoxic, and cause no damage to the machines in which they are used.[7] Because they vaporize at low temperatures, CFCs are extremely energy-efficient as coolants and are widely used in refrigerators and air conditioning equipment. CFCs are also used as aerosol spray propellants, solvents for cleaning microchips and electronic equipment, and blowing agents for styrofoam containers and packing material. The very same properties that make CFCs so efficient and effective also make them extremely harmful to the ozone layer.[8]

The problem of ozone layer depletion was initially discovered in 1974 when Dr. Sherwood Rowland and Dr. Mario Molina published a report hypothesizing that CFCs rise to the stratosphere where they break down to release active chlorine fragments that destroy ozone.[9] In addition to their ozone-depleting potential, several types of CFCs are among the major greenhouse gases which scientists have conclusively linked to global warming.[10] Because CFCs had been in use for decades and were thought to be the ideal chemical coolant, the initial reports of ozone layer depletion were alarming to those in the scientific and environmental community.[11]

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[6] Glenn B. Raiczyk, Future Development, *Montreal Protocol on Substances that Deplete the Ozone Layer: Conference Calling For Accelerated Phase-out of Ozone-Depleting Chemicals is Planned For 1992*, 5 TEMP. INT'L & COMP. L.J. 363, 365-66 (1992).

[7] *Id.*

[8] Pamela Wexler, *Protecting The Global Atmosphere: Beyond the Montreal Protocol*, 14 MD. J. INT'L L. & TRADE 1, 4 (1990).

[9] Mario Molina and Sherwood Rowland, *Stratospheric Sink for Chloroflouromethanes: Chlorine Atom Catalyzed Destruction of Ozone*, 249 NATURE 810 (1974). Because CFCs are chemically inert and intrinsically stable, they withstand immediate decomposition or oxidation. Accordingly, instead of being destroyed or rained out in the lower atmosphere as are most chemical emissions, CFCs slowly migrate to the stratosphere where they decompose in intense sunlight, thereby giving off the chlorine atoms which destroy the ozone layer. *Id.* at 810-12.

[10] *See* Jutta Brunee, *Acid Rain and Ozone Layer Depletion: International Law and Regulation*, 46-47 (1988). The Earth's mean temperature is directly controlled by the amount of sunlight coming in, and destruction of the ozone layer or an artificial change in the vertical profile of ozone is likely to affect the thermal structure of the atmosphere. The effects of net surface warming could be drastic, ranging from extreme shifts in global agriculture and food supplies, to a rise in sea level due to thermal expansion and melting of the polar icecaps. *Id.* at 47. For a thorough analysis of the relationship between CFCs and global warming, *see generally* Daniel Albritton, *Stratospheric Ozone Depletion: Global Processes in Ozone Depletion, Greenhouse Gases, and Climate Change*, 10 (1989); United Nations Environment Programme, *The Greenhouse Gases* (1987).

[11] RICHARD BENEDICK, OZONE DIPLOMACY 11 (1991).

As new uses of CFCs were found, worldwide consumption soared from 150,000 metric tons in 1960 to over 1.1 million metric tons annually by the late 1980s.[12] Furthermore, due to their high stability and extended lifetimes, almost all CFCs which had been produced since the 1930s were still in the atmosphere.[13] Industry representatives reacted to Rowland and Molina's findings by attacking the legitimacy of the research and warning of the dire social and economic consequences which would result if these refrigerants were banned.[14] The stakes were substantial indeed: at the time the scientists released their report, CFC manufacturing was a two billion dollar per year industry and employed over 200,000 people.[15]

B. Uncertainty, Debate, and Consensus

Although the Sherwood and Molina Report brought attention to ozone depletion as early as 1974, little would be known about the dangers of CFCs until many years later. The U.S. scientific community reacted swiftly to the disturbing theory by mounting a major research campaign involving the National Academy of Sciences, NASA, the National Oceanic and Atmospheric Administration (NOAA), and other leading chemists, meteorologists, and universities.[16] The primary forum for the coordination and exchange of

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[12] *Id.*; Maricel Sequeira, *Environment: Ozone's Thinning But War Will Be Won Eventually*, INTER PRESS SERVICE, Dec. 1, 1996, *available in* LEXIS, News Library, Curnws File.

[13] It is believed that CFCs may stay in the atmosphere for up to 150 years. 10 *Int'l Env't Rep.* (BNA) 162 (Apr. 8, 1987).

[14] William K. Stevens, *Three Win Nobel Prize for Work on Threat to Ozone*, N.Y. TIMES, Oct. 12, 1995, at A-1. While much of the industry's initial skepticism was justified, the attacks on Sherwood and Molina were at times intensely personal. The president of one aerosol manufacturing company publicly suggested that the scientists' report was "orchestrated by the ministry of disinformation of the K.G.B." *Id.*

[15] *Id. See also Nobel 1995- Part 1*, (CNN television broadcast, Dec. 10, 1995) (Transcript #648-1), *available in* LEXIS, News Library, Curnws File.

[16] Benedick, *supra* note 11, at 11. For a number of early studies published by the National Research Council, *see* HALOCARBONS: EFFECTS ON STRATOSPHERIC OZONE (Washington, D.C.: National Academy Press, 1976); STRATOSPHERIC OZONE DEPLETION BY HALOCARBONS: CHEMISTRY AND TRANSPORT (Washington, D.C.: National Academy Press, 1979); CAUSES AND EFFECTS OF STRATOSPHERIC OZONE REDUCTION: AN UPDATE (Washington, D.C.: National Academy Press, 1982).

information has been the United Nations Environmental Programme (UNEP).[17] In 1977, UNEP formed the Coordinating Committee of the Ozone Layer which provided a clearinghouse for scientists to present timely scientific assessments to international policymakers.[18]

The years following the Sherwood and Molina Report were marked by intense disputes between the CFC industry and environmentalists, with both sides using various scientific studies to support their respective positions.[19] Because the intrinsically unstable ozone molecules are constantly being created and destroyed by elaborate natural forces, the research complexities were enormous.[20] Scientists faced a seemingly insurmountable task in establishing a conclusive link between CFCs and ozone depletion. Wide fluctuations in the predicted effects of CFC emissions were beginning to undermine the credibility of the science and repress concern about the urgency of the problem.[21]

After more than a decade of debate and uncertainty, a consensus finally emerged that CFCs were causing the destruction of the ozone layer and immediate action was required. Perhaps the single biggest factor leading to the consensus was the result of an international cooperative venture undertaken by the scientific community. Cosponsored by NASA, UNEP, the World Meteorological Organization(WMO), and several other national

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[17] UNEP was formed in 1973 as a United Nations secretariat designed specifically to address international environmental problems. UNEP provides an objective international forum, free of the time-consuming debates on irrelevant political issues that have marred the work of other UN bodies. *See Benedick, supra* note 11, at 6. Furthermore, UNEP commands respect for its commitment and sensitivity to national interests, particularly those of developing countries. *Id.*

[18] Gerald A. Hapka, *The Montreal Protocol: A Review of Global Environmental Action*, 9 DEL. LAW 27, 28 (1991).

[19] The international chemical industry fervently denied any connection between ozone depletion and increasing sales of CFCs, and mounted a research and public relations campaign of its own to counter the growing scientific evidence against their products. Benedick, *supra* note 11, at 12.

[20] *Id.* at 11. As Benedick points out: "Ozone concentrations fluctuate wildly as a result of natural causes on a daily, seasonal, and solar-cyclical basis; indeed, during the 1960s average ozone levels actually increased. Furthermore, great geographic variations in ozone abundance occur over different latitudes, as well as at different altitudes in the atmosphere." *Id.* at 11-12. Scientists have constantly been developing complex computer model calculations of possible future ozone depletion, with every advancement in the understanding of chemistry and meteorology of the atmosphere resulting in a new and improved model. Hapka, *supra* note 18, at 27.

[21] Benedick, *supra* note 11, at 13-14.

and international organizations, the venture was the most comprehensive study of the atmosphere ever undertaken.[22] The results, published in a series of reports, stated that stratospheric concentrations of CFC 11 and 12 doubled from 1975 to 1985, and predicted that continued emissions of these CFCs at current rates could reduce the ozone layer by nine percent by the last half of the twenty-first century, with even greater seasonal and latitudinal declines.[23] The Ozone Trends Panel further found that between 1969 and 1986, ozone thinning increased from 1.7 to 3 percent in the northern latitudes that include most of the world's population, and a six percent winter time reduction had taken place in the atmosphere over Alaska and Scandinavia.[24] Based upon this research, it was certainly foreseeable that biologically harmful levels of ultraviolet radiation could reach heavily populated areas of the northern hemisphere within several years.

In 1985, British scientists published startling results of a study which revealed a "hole" in the ozone layer over Antarctica during wintertime months, which had grown progressively deeper since the late 1970s.[25] A

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[22] Anne Gallagher, *The "New" Montreal Protocol and the Future of International Law For Protection of the Global Environment*, 14 HOUS. J. INT'L L. 267, 274-75 (1992); *see also* Benedick, *supra* note 11, at 14. Also involved in the study were the Federal Aviation Administration, the West German Ministry for Research and Technology, the Commission of the European Communities, and approximately 150 scientists of various nations. *Id.* The report was published in three volumes containing almost 1100 pages of text plus 86 reference pages listing hundreds of articles. *Atmospheric Ozone 1985, Assessment of Our Understanding of the Processes Controlling its Present Distribution and Change*, Global Ozone Research and Monitoring Project Report No. 16, WMO (1986) [hereinafter *Atmospheric Ozone 1985*]. The study was unique in that it analyzed the changes and influences of the many relevant gases as a whole rather than in isolation, and accounted for the effects of naturally occurring phenomena, which had previously been problematic in atmospheric research. *See supra* notes 20 and 21.

[23] *Atmospheric Ozone 1985*, at 4. Although a 9 percent drop over many decades might not seem alarming, scientists have predicted that a 1 percent decrease in ozone would result in an increase of exposure to UV-B rays by 1.5-2 percent, and a 2 percent increase in the number of skin cancer cases. Medwin M. Mintzis, *Skin Cancer: The Price for a Depleted Ozone Layer*, 12 EPA J. 7, 7-9 (1986); *see also* Kripke Testimony, *supra* note 4.

[24] Melinda Beck with Mary Hager, *More Bad News for the Planet: A Grim Report on the Ozone*, NEWSWEEK, Mar. 28, 1988, at 63.

[25] J.C. Farman, B.G. Gardner, and J.D. Shanklin, *Large Losses of Total Ozone in Antarctica Reveal Seasonal ClOx/NOx Interaction*, 315 NATURE 207, 210 (1985). Ozone concentrations over Antarctica have been measured since 1957 and a steep decline has been observed since 1977. Brunee, *supra* note 10, at 42. While there is no actual hole in the ozone layer, the total column content of ozone in late winter and early spring decreased by

final report in the WMO/UNEP series was published in 1988 by NASA and the Ozone Trends Panel which confirmed the findings of the British study, and included the results from a NASA-led study of Antarctic ozone levels conducted the previous year.[26] The "ozone hole" was widely reported in the mainstream media, and played a key role in mobilizing public support of multilateral action.[27]

While there still existed some debate regarding the legitimacy of the ozone problem, the developments of the mid to late 1980s had firmly established a causal relationship between CFCs and damage to the ozone layer. As with most other environmental issues, there was a substantial proclivity on the part of industry to resist regulation until the research picture was complete.[28] However, given the time spans involved and the possibility that remedial actions were unlikely to have an immediate effect, it was imperative that immediate action be taken.[29] Once the wide gaps in scientific knowledge finally began to narrow, governments and CFC producers lowered their resistance to regulation.

III. THE MONTREAL PROTOCOL AND THE REGULATORY RESPONSE

After more than a decade of mounting evidence and pressure from scientists and environmental groups, it was apparent that ozone depletion was

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40 percent between 1977 and 1987. *Id.* When the hole was discovered, the amount of chlorine in the stratosphere over Antarctica was two to three times its normal level, and as of 1996 was five times the natural level. *Independent Findings Confirm Ozone Layer Damage Worse*, Business Publishers, Inc., World Environment Report, No. 4, Vol. 22, Feb. 14, 1996, *available in* LEXIS, News Library, Curnws File.

[26] NAT'L AERONAUTICS & SPACE ADMIN., *EXEC. SUMMARY OF THE OZONE TRENDS PANEL REPORT* (1988). The summary was issued by over one hundred of the world's most distinguished scientists and incorporated both ground-based and satellite data from a comprehensive eighteen month study of ozone layer depletion over the Antarctic. Joel A. Mintz, *Progress Toward a Healthy Sky: An Assessment of the London Amendments to the Montreal Protocol on Substances that Deplete the Ozone Layer*, 16 YALE J. INT'L L. 571, 575 (1991).

[27] *See, e.g., A Gaping Hole in the Sky*, NEWSWEEK, July 11, 1988, at 21.

[28] *See* Wexler, *supra* note 8, at 11.

[29] If policies for controlling the emission of CFCs were not developed until after actual harm to plants or animals, the effects could persist for decades. *See* Hapka, *supra* note 18, at 28. Hapka further explains the difficulty of developing consensus for action: "Thus, one lesson learned from the ozone depletion issue is that when society is dealing with a global and intergenerational concern it must develop, in parallel, the capability to define the state of the science, to measure and test theory with hard evidence, and to predict likely future outcomes resulting from man's activity." *Id.*

a problem to be taken seriously. However, the global nature of ozone depletion made defining and controlling the problem much more difficult than other environmental issues.[30] As it became generally accepted that ozone layer depletion would pose serious threats to human health and the environment, the debate among governments, scientists, and industry focused instead upon the extent of international action necessary to provide a reasonable degree of protection.[31]

In response to the early findings on ozone depletion, cursory regulatory measures were imposed in the United States, Canada, and several European countries in the late 1970s and early 80s. The United States unilaterally prohibited the use of CFCs as aerosol propellants in nonessential applications,[32] and Canada, Norway, and Sweden soon followed with similar bans of their own.[33] In addition, the EPA was under a court order to formulate ozone-protecting regulations under the Clean Air Act by 1987.[34] Under pressure to respond to action taken by the U.S., the European Community passed regulations calling for cutbacks in CFC production which were widely criticized as being superficial and ridden with loopholes.[35] These attempts at regulating ozone-depleting chemicals may have been commendable, but essentially were little more than symbolic gestures.[36] Although the vast

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[30] The Global nature of the problem is cogently described as follows: "Frustrating a solution to this threat is the virtual impossibility of pinpointing and controlling all of the sources of these chemicals: CFCs are produced and used all over the world, yet the damage is occurring where we can be almost certain that no CFCs are being produced—in Antarctica. Even if it were possible to somehow trace all of the sources of these hazardous chemicals, prior international accords offer little guidance for solving environmental problems where responsibility cannot be apportioned. A solution to the problem of ozone depletion thus depends on unprecedented international cooperation." Wexler, *supra* note 8, at 4-5.

[31] *See* Benedick, *supra* note 11, at 22.

[32] Toxic Substances Control Act, 15 U.S.C. sec. 2605, sec. 6; 43 *Fed. Reg.* 11301-19 (1978). U.S. production of CFCs for aerosols quickly fell by 95 percent, as economical substitutes had already been developed. Benedick, *supra* note 11, at 24.

[33] Benedick, *supra* note 11, at 24.

[34] NRDC v. Thomas, No. 84-3587, slip op. (D.D.C. May 17, 1986).

[35] The EC enacted a 30 percent cutback in CFC aerosol use from 1976 levels, but this was criticized as being a trivial target since use had already declined by over 28 percent due to measures previously taken by West Germany. Benedick, *supra* note 11, at 24-25. In addition, "production capacity" was defined to allow 24 hour-a-day plant operation which would actually allow CFC output to increase substantially. *Id.*

[36] Bans on the use of CFCs in aerosol cans were quickly offset by increased CFC use in other products and other countries, nullifying the benefits of the regulation. Elizabeth P. Barratt-Brown, *Building a Monitoring and Compliance Regime Under the Montreal Protocol*, 16 YALE J. INT'T L. 519, 526 (1991).

majority of CFCs are produced and consumed in developed countries, once the chemicals are emitted they may travel anywhere in the atmosphere.[37] Clearly, continued unilateral action on the part of any one country would be futile.

In 1985, the parties to the UNEP Working Group[38] met in Vienna in the first attempt at a multilateral response to ozone depletion. Although the parties did not agree on a control protocol, those states present signed a framework convention and pledged to adopt a protocol within two years.[39] Over the next two years, advances in scientific knowledge about climate and the atmosphere, combined with disturbing results of recent studies,[40] would provide the driving force behind what was hailed as "the most significant international environmental agreement in history."[41]

On September 16, 1987, after several months of complex and often heated debate,[42] representatives of 23 nations and the EEC signed the Montreal Protocol on Substances that Deplete the Ozone Layer.[43] The Protocol first established a freeze in production and consumption of CFCs at 1986 levels, and then called for a subsequent reduction in CFCs over the following decade. The Protocol provided that as of July 1, 1989 the calculated annual

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[37] Ozone layer depletion differs from other transboundary problems such as acid rain in that its effects are not simply regional, but carry global implications. While emission reductions in one country would benefit all other countries, those which do not consume CFCs are powerless to prevent the danger that ozone depletion holds for them. Brunnee, *supra* note 10, at 77-78.

[38] The Working Group was formed by UNEP in 1981 to develop a framework convention to which control protocols could be added, and to garner support for action to protect the ozone layer. *Final Report of the Ad Hoc Working Group of Legal and Technical Experts for the Elaboration of a Global Framework Convention for the Protection of the Ozone Layer on its First Session*, U.N. Envt'l Programme, at 2, U.N. Doc. UNEP/IG.53/4 (1985).

[39] *Vienna Convention for the Protection of the Ozone Layer*, Mar. 22, 1985, *reprinted in* 26 I.L.M. 1516 (1987). The high level of scientific uncertainty and disagreement over suitable control measures prevented the adoption of a protocol with the convention. *See Gallagher*, *supra* note 22, at 282.

[40] *See supra* notes 22-24 and accompanying text.

[41] Reagan, *supra* note 2.

[42] *See* Benedick, *supra* note 11, at 77-97. Key points of debate centered around which chemicals would be included, the extent of the cutbacks, and treatment of developing countries, non-participating countries, and special provisions for the EC. *Id.* On a more general level, rudimentary disputes still existed between countries which felt that no regulation was needed and others which believed that nothing less than a complete phase-out of CFCs was essential. Hapka, *supra* note 18, at 28.

[43] Montreal Protocol, *supra* note 1.

consumption of CFCs[44] could not exceed the 1986 level, with consumption dropping to 80 percent of 1986 levels in 1993 and 50 percent in 1998.[45]

The original reduction targets dictated by the Protocol were criticized by some as being overly ambitious. As with most forms of "command and control" environmental regulation, there was a great deal of anxiety about the potential economic impact of the restrictions on both producers and consumers of CFCs. In order to achieve its goal of eliminating ozone-depleting substances, the Protocol depends upon a detailed scheme of cooperation among signatories, trade restrictions, and economic incentives designed to result in the development of new technologies and substitute products. For example, the agreement requires cooperation among signatories in research, development, and exchange of information on the best technologies for improving the recycling and containment of CFCs, and encouraging development of alternative substances.[46] The Protocol signatories are also required to promote public awareness of the effects of ozone-depleting substances, and to submit to the Secretariat a summary of activities the party has conducted pursuant to the requirement.[47] Through these reduction standards, the supply of CFCs will decrease, thereby making the refrigerants more costly to consumers. It is intended that such cost increases will facilitate the development of ozone-harmless alternative refrigerants.

While the original signatories to the Montreal Protocol produce and consume the vast majority of the world's ozone-depleting chemicals, total global compliance must be encouraged if the agreement is to have any significant impact.[48] Accordingly, the Protocol bans signatories from importing CFCs or products containing them from any country not a party to the agreement.[49] Likewise, exports from signatories to non-signatories

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[44] Consumption was to be reduced in five types of CFCs: CFC 11, CFC 12, CFC 113, CFC 114, and CFC 115. *Id.* annex A.

[45] *Id.* art. 2, para. 4.

[46] *Id.*, art. 9, para 1.

[47] *Id.*, art. 9, para 2.

[48] According to many scientists, total global compliance with the Montreal Protocol is quintessential in order to restore the atmosphere to the conditions predating the Antarctic ozone hole. *See Antarctic Ozone Depletion More Rapid Than During Any Other Period, WMO Reports*, 20 Envt'l Rep. (BNA) 936 (Sept. 22, 1995).

[49] *Montreal Protocol, supra* note 1, art. 4, para. 1.

are to be banned unless made in compliance with the reduction measures.[50] Perhaps most important to the Protocol's ultimate success was the participation of developing nations.[51] This was encouraged by granting developing countries ten year delayed compliance with the reduction schedule,[52] and requiring the developed signatories to offer assistance and access to alternative substances and technologies.[53]

As previously noted, scientific understanding of the atmosphere and ozone depletion was subject to constant revision and analysis. The Protocol's signatories recognized that if the agreement was to continue as a dynamic and effective force in ozone layer protection, it would have to be flexible and able to adapt to changing conditions and information. Accordingly, the Protocol requires periodic reassessment of the control measures "on the basis of available scientific, environmental, technical, and economic information" beginning in 1990 and recurring at least every four years thereafter.[54] On the basis of such information, the control schedules for production and

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[50] *Id.* art. 4, para. 2. All parties are required to discourage the proliferation of CFC production technology among nonparties. *Id.* art. 4, paras 5-6. Conversely, parties are encouraged to export products, capital, or technology which tends to reduce CFC consumption. *Id.* art. 4, para. 7.

[51] At the time of the Protocol, developing nations produced less than ten percent of the world's CFCs, yet accounted for almost all of the growth in CFC use. 10 Int'l Envtl. Rep. (BNA) 534 (Oct. 14, 1987). Enormous increases in CFC production and consumption could take place in heavily populated, developing countries that had not yet acceded to the agreement, which would more than offset any reduction in CFC use by the Protocol signatories.

[52] *Id.* art. 5, para. 1. Developing countries are commonly referred to as "Article 5 Countries" under the Protocol, while industrialized nations are referred to as "Article 2 Countries." The delay was granted to allow participating developing countries to meet their basic domestic needs. *Id.* Because developing countries consider the problem as one caused mainly by the earlier production methods of the western world, they tend to insist that the primary and major steps in limiting emissions should come from these nations. Katrien Vorlat, *The International Ozone Regime: Concessions and Loopholes?*, 17 FLETCHER FORUM OF WORLD AFFAIRS 135, 147 (1993). These countries understand the need for action, but resist compliance at the expense of their own development. *Id.*

[53] Montreal Protocol, *supra* note 1, art. 5, paras. 2-3. If adequate supplies of refrigeration and other affected technologies are not available through international trade, developing countries might forego participation in the Protocol and instead build new CFC production facilities. See Hapka, *supra* note 18, at 29. Indeed, several countries previously without CFC production capacity and low rates of consumption have recently constructed new plants for current and future needs. *Id.*

[54] Montreal Protocol *supra* note 1, art. 6.

consumption of ozone-depleting substances may be adjusted as necessary.[55] Most experts agree that the provision has been essential in preserving the vitality of the agreement.

Responding to new reports of an alarming increase in ozone layer depletion, environmental representatives from 93 nations met in London in 1990 to consider changes to the original Protocol.[56] The result was an agreement to move forward the phase-out dates for CFC production and use by the end of the century.[57] An equally important development at the London Conference was the establishment of a $160 million multilateral fund to assist developing countries in the switch to safe CFC substitutes and to further encourage their compliance with the protocol.[58] The Multilateral Fund is to be capitalized with voluntary contributions from industrialized countries, and in order for an Article 5 country to receive funding, it must regularly submit reports to the Secretariat regarding its progress in phasing out CFCs.[59]

Soon after the parties to the London conference adjourned, scientists released more troubling information concerning the ozone layer. In 1991, scientists discovered significant amounts of ozone layer depletion over Scandinavia,[60] and other studies showed that ozone levels had declined by

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[55] *Id.* art. 2, para. 9(c).

[56] See *Report of the Second Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer*, U.N. Envt'l Programme, U.N. Doc. EP/Oz.L/Pro.-2/3 (1990), *reprinted in* 30 I.L.M. 537 (1991) [hereinafter London Amendments].

[57] The London Amendments required industrial nations to eliminate the use of CFCs by 2000, and allowed developing countries until 2010. *Id.*

[58] *Id.* The main purpose of the fund was to secure the participation of India and China, who had previously viewed unrestricted CFC production and use as vital to their economic development. *See Parties to Montreal Protocol Agree to Phase Out CFCs, Help Developing Nations*, 7 Int'l Envtl. Rep. (BNA) 275 (July 11, 1990). While India and China are not yet significant ozone-depleters, they are rapidly developing and account for almost 40 percent of the world's population. Accordingly, their involvement was crucial to the Protocol's success. *See supra* notes 51-53 and accompanying text. The Multilateral Fund is to be administered by an executive committee of fourteen parties which makes grants, acts as a clearinghouse for technical cooperation and training, and provides other means of financial assistance. *See* London Amendments, *supra* note 56, annexes II, IV, and V.

[59] *Id.* For an in-depth analysis of the Protocol's Multilateral Fund, *see* Jason M. Patlis, *The Multilateral fund of the Montreal Protocol: A Prototype for Financial Mechanisms in Protecting the Global Environment*, 25 CORNELL INT'L L.J. 181, 199 (1992).

[60] *Scientists Detect Hole in the Ozone Above Three Scandinavian Nations*, 14 Int'l Envtl. Rep. (BNA) 68 (1991).

ten percent over the middle latitudes of Europe and North America.[61] In the wake of this alarming news, the parties to the Protocol met in Copenhagen in 1992, where phase-out dates for CFCs were accelerated to 1996 for industrialized nations.[62]

Throughout the 1990s, scientists have continued to make alarming discoveries concerning the extent of ozone layer depletion. A study by two Canadian scientists released in 1993 found significant increases in hazardous UV rays reaching the earth's surface over the previous four years, and these increases were causally linked to the destruction of the ozone layer.[63] In 1996 the hole in the ozone layer over Antarctica was the largest on record at over 22 million square kilometers, approximately twice the size of Europe.[64] Measurements indicated that the ozone hole had expanded north to cover southern parts of South America, exposing over 200,000 people to harmful levels of ultraviolet radiation.[65] Furthermore, a recent study produced solid evidence that elevated levels of ultraviolet radiation are beginning to cause deformities and genetic damage to plants and wildlife in the southern hemisphere.[66]

By the end of 1996, 157 countries had ratified the original Montreal Protocol, including 110 from the developing world.[67] The United States

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[61] Philip Shabecoff, *Scientists Report Faster Ozone Loss*, N.Y. TIMES, June 24, 1990, at 13. *See also* Robert Pool, *Ozone Loss Worse Than Expected*, 350 NATURE 451 (1991).

[62] *Report of the Fourth Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer*, U.N. Envt'l Programme, U.N. Doc. EP/Oz.L/Pro/WG:1/7/4-(1992), *reprinted in* 32 I.L.M. 874 (1993). The CFC phaseout date for Article 5 (developing) countries remained at 2010. *Id.*

[63] Jim Kett and C.T. McElroy, *Recent Developments in Ozone Depletion*, SCIENCE, Nov. 1993. The study was noteworthy because it measured increased ultraviolet radiation in a populated area (Toronto), which put the dangers of ozone depletion into real terms for the public.

[64] Sequeira, *supra* note 12.

[65] *Independent Findings Confirm Ozone Layer Damage Worse*, World Env't Rep., IAC Newsletter Database, Feb. 14, 1996, *available in* LEXIS, News Library, Curnws File. The duration of the hole has expanded from a few days to almost three months, and ozone layer damage was detected as far north as the Tropic of Capricorn. *Id.*

[66] Roger Atwood, *Ozone Hole Starts Taking its Toll in Antarctica*, REUTERS WORLD SERVICE, Feb. 12, 1997, *available in* LEXIS, News Library, Curnws File. The study emphasized that the effect of the ozone hole on humans is still in the realm of speculation. However, scientists noted that the risk of developing skin cancer in Britain has risen by as much as ten percent due to higher levels of ultraviolet radiation. *Id.*

[67] *United States Environmental Award Goes to Ozone Protection Expert in United Nations Agency*, M2 PRESSWIRE, Oct. 28, 1996, *available in* LEXIS, News Library, Curnws File.

has implemented the terms of the Protocol through the 1990 Clean Air Act,[68] while the primary means of implementation for the European Community has been through its Environmental Council.[69] As mandated under the Copenhagen Amendments, industrialized nations ceased production of CFCs for domestic consumption on January 1, 1996.[70] While Article Five (less developed) nations have until 2010 to eliminate production of CFCs, many of these countries have announced that they will achieve a total phaseout well in advance of the Protocol deadline.[71] Much to the satisfaction of the scientific and environmental communities, the complete elimination of CFCs was finally becoming a reality.

In perhaps the most interesting recent development, Sherwood Rowland and Mario Molina were awarded the 1995 Nobel Prize in Chemistry for their groundbreaking work two decades earlier,[72] which explained the chemical processes that result in ozone layer depletion.[73] Their award was the first Nobel Prize ever given for work in the environmental sciences, and was acknowledged by many as a vindication for the two scientists who were maligned by the chemical industry upon initial publication of their thesis.[74] In announcing the award, the Royal Swedish Academy of Sciences credited the scientists for providing the driving force behind the Montreal Protocol

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[68] Clean Air Act Amendments of 1990, Title VI-Stratospheric Ozone Protection, 42 U.S.C. §§ 7450-59.

[69] *Ozone Layer: EC Agrees to Phase Out CFCs by January 1995*, EUR. INFO. SERV., Jan. 7, 1993, *available in* LEXIS, Europe Library, Alleur File.

[70] *See* Thomas A. Mahoney, *As Industry Faces 1996, CFC Spigot is Turned Off; Chlorofluorocarbon Production Ceases, Affecting Air Conditioning and Refrigeration Industry; CFC Deadline: Industry Perspectives*, AIR CONDITIONING, HEATING, & REFRIGERATION NEWS, Vol. 196, No. 16, Pg. 3 (Dec. 18, 1995). The EC phased out the production of CFCs on January 1, 1995, a full year in advance than the deadline required under the Copenhagen Amendments. *See supra* note 62.

[71] The Malaysian government has announced it will completely phaseout CFCs by 2000. *Official Expects Successful Phaseout of ODS Use in Malaysia by 2000*, Ozone Depletion Network Online Today (June 1, 1995), *available in* LEXIS, News Library, Curnws File. The government of Thailand announced a complete phaseout of CFCs effective January 28, 1997. *Thai Ban on Use of CFCs Effective on Tuesday*, REUTERS WORLD SERVICE, Jan. 27, 1997, *available in* LEXIS, News Library, Curnws File.

[72] *See supra* note 9.

[73] *See* Stevens, *supra* note 14. The third reciepient was Dutch scientist Dr. Paul Crutzen, who discovered in 1970 that the ozone layer has a natural means of being destroyed through chemical reaction with nitrogen oxides. *Id.*

[74] *Id.*

and contributing to the world's salvation from a global environmental problem that could have catastrophic consequences.[75]

IV. A THREAT TO THE MONTREAL PROTOCOL: THE INTERNATIONAL BLACK-MARKET TRADE IN CFCS

The Montreal Protocol has been lauded as a prime example of how solutions to complex environmental problems can be developed through international law and diplomacy. Unfortunately, however, implementation of the Protocol has led to some unforeseen problems which could jeopardize the agreement's ability to prevent irreversible damage to the earth's ozone layer. As industrialized countries approached the 1996 phaseout date for CFC production, supplies of legally produced CFCs dropped and prices skyrocketed.[76] Contemporaneously, developing nations continued to produce increasing amounts of CFCs at relatively cheap prices, which is completely lawful under the Protocol's delayed phaseout provisions. This disparity quickly resulted in the creation of an international black market trade in the banned refrigerants which threatens the effectiveness of the Montreal Protocol and the health of our planet.[77]

A. The Mechanics of the Black Market

The black market first originated in an effort to circumvent a gradual excise tax imposed on CFCs by the U.S. government in 1990.[78] Designed to encourage consumers to make the transition from CFCs to more ozone-friendly substances, the tax was gradually increased as the 1996 phaseout deadline approached.[79] By smuggling CFCs into the United States from developing countries, importers could make substantial profits by avoiding payment of the tax.[80] While tax avoidance remains a large motive behind the

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[75] *Id.*

[76] Martha M. Hamilton, *Rising Illegal Imports of CFCs Slow Effort to Protect Ozone Layer*, WASH. POST, Jan. 26, 1996, at D1.

[77] *Id.*

[78] *Id.*

[79] *Id.*

[80] CFC 12, the refrigerant commonly known as Freon, is typically sold in 30 pound cylinders. *Smugglers' New, Hot Cargo is Freon; Hefty Tax Boosts Coolant's Price, Covert 'Imports'*, CHI. TRIB., Nov. 5, 1995, at C-16. Due to the federal excise tax, the U.S. market price of a 30 pound cylinder of CFC-12 rose from around $20 in the early 1990s to around

black market, since the 1996 phaseout the illegal trade has primarily been due to the disparity between supply and demand. Although substitute refrigerants are performing well and are being used in increasing numbers of products,[81] there are still hundreds of millions of refrigerators and air conditioners worldwide which continue to use the banned coolants.[82] Accordingly, demand for the ozone- depleting substances remains very strong around the globe. Because Article 5 countries may continue to produce CFCs until 2010, virtually unlimited supplies exist in those nations. Declining stockpiles of legally produced CFCs in Article 2 nations have caused the market prices of these refrigerants to soar, resulting in an increase of illegal imports from developing nations. As prices of existing CFCs continue to rise, users are expected to buy increasing amounts of illegal CFCs off the prospering black market.

It is estimated that between 9000 and 18,000 tons of CFCs are being illegally imported into the U.S. each year,[83] and the refrigerants have become second only to cocaine in terms of dollar volume as an illegal import into the United States.[84] Indeed, the profits to be made through CFC smuggling are enormous: a 30 pound cylinder of CFCs can be purchased overseas for less than $35, and then resold *sans* excise tax for over $500 in

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$265 in 1995. *Id.* By avoiding the excise tax, smugglers can make enormous profits. *Id.*

[81] Most air conditioning equipment made in 1994 and beyond uses HFC 134a, and all new refrigeration equipment is running on HFCs, which do not contain ozone-depleting chlorine. John Hoffman, *CFC Retrofitting Slow for Small Users*, CHEMICAL MARKETING REPORTER, Vol. 247, no. 19 (May 8, 1995).

[82] John Hoffman, *CFC Alternatives Making Progress*, CHEMICAL MARKETING REPORTER, Vol. 247, No. 1 (Jan. 2, 1995) [hereinafter *Hoffman Report*]. Of the 250 million automobiles worldwide which contain ozone-depleting air conditioning systems, roughly 130 million are within the U.S. *Texas Border Officials Set Zero-Tolerance for CFC Traffic; Chlorofluorocarbons, Report From Houston*, CHEMICAL MARKETING REPORTER, Vol. 250, No. 6 (Aug. 5, 1996). Automobile air conditioners tend to break down after four or five years, thus ensuring significant demand for CFCs for several years to come. *See Hoffman Report, supra.*

[83] Nathan Stuart, *Wanna Buy Any Hot CFCs? Smuggling of Chlorofluorocarbons*, PROCESS ENGINEERING, Vol. 77, No. 6, Pg. 13 (June 1996). The Washington D.C.-based group, Ozone Action, estimated that up to 22,000 tons of CFCs were illegally imported in 1994, and at least 10,000 tons in 1995. Jim Vallete, Ozone Action, *Deadly Complacency: US CFC Production, the Black Market, and Ozone Depletion* (1995), at 16 [hereinafter *Deadly Complacency*]. Officials believe that the illegal imports comprise as much as thirty percent of the total U.S. market for CFCs. *See* Martha Hamilton, *supra* note 76.

[84] *See Deadly Complacency, supra* note 83, at 4.

the United States.[85] Customs officials believe that the imports are likely being smuggled in from Article 5 countries through a complex series of shipments and customs-evading maneuvers.[86] Under the terms of the Protocol, importing recycled CFCs from developing countries is permitted if the goods are later re-exported to other developing countries.[87] However, it is difficult to distinguish between virgin CFCs and recycled product, and the monitoring of trade in these chemicals is not well developed.[88]

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[85] Pratap Chatterjee, *U.S. Environment: Customs Agents Crack Down on Freon Smugglers*, INTER PRESS SERVICE, Feb. 19, 1997, *available in* LEXIS, News Library, Curnws File. In some cases, the price of a 30 pound cylinder can approach $900 if purchased in small quantities. *Id.* Thomas Watts-Fitzgerald, Assistant U.S. Attorney, notes that while purchase and distribution of crack cocaine brings a 4 to 1 profit ratio, purchasing refrigerants overseas for resale on the U.S. black market can produce a 13-to-1 profit ratio. *Illegal Shipments of Freon Keeping U.S. Customs Busy*, N.Y. TIMES SERVICE, Nov. 10, 1996.

[86] *See Deadly Complacency*, *supra* note 83, at 16. Illegal importers use many industrial countries as transshipment points, and the CFCs likely enter the U.S. under the auspice of being re-exported to developing countries. However, instead of being re-exported, the CFC containers are diverted into the black market, while false manifests and declarations are filed so as not to arouse the suspicion of U.S. Customs officials. *Id.* at 19-21. As Vallette writes in *Deadly Complacency*, a close examination of shipping records reveals numerous such transactions. For example:

> Excessive shipments can indicate the use of a country as a false destination. The Protocol allows developing countries a consumption cap of 0.3 kilograms of CFCs per capita. Exports to two Caribbean territories—the Netherlands Antilles and the Cayman Islands—exceeded this cap. The Netherlands Antilles, for example, are listed as receiving more than 1572 metric tons of CFCs from the United States in 1994; imports continued in 1995 at a rate of more than 2000 metric tons per year. With a population of about 300,000 people, the territory may consume a maximum of 99 tons of CFCs per year. As Assistant U.S. Attorney Thomas Watts-Fitzgerald said, the excessive exports listed as going to the Netherlands Antilles are "enough to put a dome over it and cool it until the next century."

Id. at 16. At one time, Miami was alleged to be the center of the illegal trading in CFCs, not surprising given that the port is the main trading intersection between the United States and Latin America, a major source of the illegal imports. The port of Miami annually handles over four million shipping containers entering and leaving U.S. territory every year. *Id.* at 19. Given this huge volume of commerce, it is relatively easy to understand how large quantities of illegal CFCs can slip in undetected.

[87] Montreal Protocol, *supra* note 1, art. 2.

[88] Kristine Chin, *Customs, EPA Crack Down on CFC Crooks*, CHEMICAL ENGINEERING, Vol. 103, No. 4, Pg. 43 (Apr. 1996). Because the federal excise tax previously applied only to virgin CFCs, smugglers often claimed to be importing recycled CFCs that were actually

In response to the illegal CFC imports, the U.S. government launched a joint sting operation involving the EPA, the U.S. Customs Service, and the Internal Revenue Service.[89] The operation has resulted in several major busts of illegal CFC import schemes,[90] and by late 1996 was responsible for the seizure of 20 shipments totalling 1,208,960 pounds of illegal CFCs.[91] In addition to the widely-publicized busts, "Operation Cool Breeze" resulted in the first-ever extradition for an environmental crime,[92] and the first felony convictions for violation of the 1990 Clean Air Act Amendments on ozone-depleting substances.[93]

The concerted enforcement effort has been somewhat effective, as illegal CFC shipments into Miami have slowed to a trickle in recent months.[94] However, U.S. Customs officials suggest that this may only reflect a change

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virgin substances in order to circumvent the tax. *Id.*

[89] Dubbed "Operation Cool Breeze," the operation also included the FBI, CIA, and Interpol. Pratap Chatterjee, *Environment: Black-market Chemicals Destroying Ozone Layer*, INTER PRESS SERVICE, Sept. 14, 1995, *available on* Westlaw, Allnews Database.

[90] In 1995, U.S. Attorneys won convictions against eight Miami individuals for illegally importing CFCs into the U.S. *See* Jim Vallette, *Allied Signal, Quimobasicos, and the Frio Banditos: A Case Study of the Black Market in CFCs*, 15 (1996) [hereinafter *Case Study*]. In May of 1995, Adi Dubash and Homi Patel were convicted in federal court for conspiring to divert seven containers (containing 126 tons of CFC-12 produced in India) into U.S. commerce. U.S.D.C., S.D. Florida, Case No. 95-0026, court records. In August of 1995, a Miami shipping executive was convicted on 34 counts of filing fraudulent export declaration for over 4000 tons of CFCs from December 1993 to March 1995. U.S.D.C. records, S.D. Florida, Case No. 95-0250 and Case No. 95-0058. On September 4th, 1996, a federal grand jury handed down a 164 count indictment charging a Miami enterprise named "Refrigeration USA" and three individuals with smuggling 4000 tons of CFCs from the U.K. *See Case Study*, *supra*. The Assistant U.S. Attorney prosecuting the case indicated that those charged were interconnected with several other Miami importers previously convicted of CFC smuggling. *Id.*

[91] *Miami's "Operation Cool Breeze" Team to Receive Prestigious Stratospheric Ozone Protection Award*, PR NEWSWIRE, Oct. 22, 1996, *available in* LEXIS, News Library, Curnws File [hereinafter *Ozone Award*]. The seized shipments had a market value of approximately $32 million. *Id.*

[92] In June of 1996, Bruce Burrell was extradited to the U.S. from Costa Rica, and was later convicted for conspiracy to smuggle CFC-12 into the U.S. *News Release*, U.S. Dept. of Justice, Nov. 24, 1996, available in LEXIS, News Library, Curnws File.

[93] *See* Chatterjee, *supra* note 89. In October of 1996, the team of federal agents and prosecutors involved in "Operation Cool Breeze" received the EPA's prestigious "Stratospheric Ozone Protection Award" for their work in combatting the black market trade in CFCs. *See Ozone Award*, *supra* note 91.

[94] *See* Chatterjee, *supra* note 85.

in smuggling routes and methodology.[95] Recent evidence seems to confirm their beliefs, as illegal imports of CFCs across the U.S.-Mexican border have surged during the last half of 1996,[96] and a similar increase in smuggling has occurred at the U.S.-Canadian border.[97] In contrast to the large shipping containers full of illegal CFCs which characterized the black market trade through South Florida, the current scheme consists mainly of small-scale smugglers who transport individual CFC cannisters across the border by cars, trucks, and sometimes even on foot.[98] Because Mexico is classified as an Article 5 country under the Montreal Protocol, it can legally produce CFCs until 2010.[99] The illegal imports from south of the border are a perfect illustration of how the disparate treatment of industrialized and developing nations is driving the black market trade in CFCs.[100] As U.S.

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[95] *Id.*; *see also Case Study*, *supra* note 90, at 14.

[96] Vallette's report, *Allied Signal, Quimobasicos and the Frio Banditos: A Case Study of the Black Market in CFCs*, provides a detailed account of the new smuggling routes and mechanics of the black market trade in CFCs. *See Case Study*, *supra* note 90.

[97] Robert Benzie, *Freon Smugglers Find Canada's a Gas*, THE TORONTO SUN, Jan. 13, 1997, at 7. The supplies are believed to be coming from Canada's legally produced stockpiles. Due to the nation's abundant supply and lack of an excise tax, CFCs are legally purchased in Canada for U.S. $3 per pound, and resold in the U.S. for as much as $25 per pound. *Id.*

[98] *See Case Study*, *supra* note 90, at 28-33. Vallette explains that due to the large number of small-scale smugglers, the vast stretches of open border, and the shadowy nature of the business, it is nearly impossible to estimate the volume of illegal CFCs being smuggled in from Mexico. *Id.* at 20-23. Although Customs officers at the Mexican border have seized several thousand pounds of CFCs over the past year, this likely represents a small fraction of what is actually coming in. *Id.*

[99] Like many other Article 5 nations, the Mexican government has announced that it intends to phase-out CFC consumption by 2000. *Id.* at 27.

[100] As the 1996 phaseout date approached for industrialized nations, many multinational chemical companies relocated their CFC manufacturing operations to Article 5 countries. In *Allied Signal, Quimobasicos and the Frio Banditos: A Case Study of the Black Market in CFCs*, Jim Vallette explains that Allied Signal, a U.S. chemical company, ended most of its CFC production in the U.S. at the end of 1995, while concentrating the remainder of its operations in two separate CFC manufacturing plants. *Id.* at 25. One of these plants, Quimobasicos, was established in Monterrey, Mexico, just 200 miles from the U.S. border. Quimobasicos is operated as a joint venture between Allied Signal and its Mexican counterpart Cydsa, and is the source of a vast majority of the CFCs being smuggled into the United States. *Id.* at 20-23. Vallette points out that while the Quimobasicos plant is a perfectly legal operation and has not purposefully directed its product into the black market, the company has virtually no control over the CFCs once they leave factory grounds and enter the Mexican marketplace. *Id.* at 23. U.S. Customs officials are particularly distressed about

consumer demand chases a shrinking supply of legally-produced CFCs, the flood of illegal imports from abroad is certain to intensify in the years ahead.[101]

Although the black market trade is most pronounced in the United States,[102] many other Article 2 nations are experiencing similar problems. For example, when the European Union banned production of CFCs after 1994, it likewise encountered a boom in illegal imports.[103] The chemical industry recently estimated that approximately 10,000 metric tons of CFCs (worth 100 million British pounds) are being illegally marketed in Europe.[104] While the evidence of a European black market is largely circumstantial, several recent developments indicate that a black market indeed exists.[105] The large majority of CFCs smuggled into the E.U.

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the proximity of a nearly unlimited supply of CFCs to the strictly regulated U.S. market. *Id.* at 20. In March of 1997, Mexico's Federal Environmental Protection Enforcement Agency began a comprehensive investigation involving illegal CFC exports to the United States. *Mexican Authorities Investigating Black Market in CFC Exports to United States*, BNA INT'L ENV'T DAILY, Apr. 15, 1997.

[101] Recently, the U.S. Department of Justice and the Environmental Protection Agency announced a renewed effort to crack down on illegal CFC smuggling into the United States. U.S. Attorney General Janet Reno, Remarks at a Justice Dept. Hearing (Jan. 9, 1997), Federal News Service, *available in* LEXIS, News Library, Curnws File.

[102] The CFC black market is most conspicuous in the U.S. for two reasons: (1) the fact that about ninety percent of U.S. automobiles are fitted with air-conditioning systems, compared to about ten percent of European cars; and (2) the U.S. excise tax on CFCs created a large incentive for tax avoidance which was not present in the European Union. *Ozone Depletion: Montreal Protocol Threatened by Illegal Trade in CFCs, Report Finds*, BNA INT'L ENV'T. DAILY, May 10, 1996 (citing Duncan Brack, *International Trade and the Montreal Protocol*, 1996, *infra* note 105).

[103] *As Prices Soar, CFC Black-Market Expected to Increase in EU*, Ozone Depletion Network Online Today (January 18, 1995), *available in* LEXIS, News Library, Allnws File.

[104] Paul Brown, *Europe's 'CFC Gangsters' Face Hard Line*, THE GUARDIAN, The Guardian Home Page, Pg. 5 (Oct. 17, 1996), *available in* LEXIS, News Library, Curnws File.

[105] Duncan Brack, Senior Research Fellow at the Royal Institute of International Affairs, notes that CFC prices in Europe have not risen as fast as might be expected, which likely indicates the existence of illegal supplies. Duncan Brack, ROYAL INST. OF INT'L AFFAIRS, INTERNATIONAL TRADE AND THE MONTREAL PROTOCOL 110 (Earthscan Publications, Ltd., 1996). Trade statistics reveal that the U.K. imported 3800 tons of CFCs from Russia during the first six months of 1995, despite having permission under the Protocol to import only 500 tons from Russia for the entire year. *See Case Study*, *supra* note 90, at 15. In July of 1996, THE SCOTSMAN published reports of a fax sent by an Indian marketing agency to companies in Denmark, which contained an offer to sell unlimited supplies of CFCs from one of the largest CFC plants in southeast Asia. *Id.* at 17. In September of 1996, a chemical industry

appear to be coming from Russia,[106] and experts believe that the European smugglers are using many of the same fraudulent techniques employed by their American counterparts.[107] Some European countries have vowed to crack down on the black market; thus far, however, enforcement has been lacking.[108] In addition to the illegal trade in Europe, substantial black markets for CFCs have been detected in Taiwan, Korea, and Hong Kong.[109] Based on existing evidence, it appears safe to conclude that the black market trade in CFCs has become a worldwide problem.

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lobby group claimed to have evidence of a Dutch merchant offering to sell CFCs illegally imported from Russia. *Id.* at 17.

[106] As Duncan Brack writes:

> All the evidence suggests that Russia is a significant source of most of the illegally traded materials. The Russian government has taken no serious actions to apply controls to its manufacturing sector, and hard currency earnings are a major temptation in an economy undergoing such dramatic convulsions. Individual plants may simply produce above their official quota, and sell the surplus on the black market.

Brack, *supra* note 105, at 112. While the Russian government claimed that it produced 44,000 tons of CFCs in 1994, independent estimates place Russia's production capacity at 100,000 tons annually. *Id.* at 112-13. It is believed that Russia is producing as much as 70,000 tons annually, with tens of thousands of tons of CFCs being funnelled into the black market. *Id.* Russian-produced CFCs make up a large portion of the U.S. black market as well, as several hundred tons of the substances have been confiscated in the U.S. since 1994. *See Case Study*, *supra* note 90, at 10.

[107] Smuggling methods include transshipment schemes in which the CFCs never reach the purported final destination, mislabeling virgin CFCs as "recycled," or simply disguising the refrigerants as another product altogether. *See* Brack, *supra* note 105, at 108-13.

[108] *Id.* In October 1996, John Gummer, the U.K. Environmental Secretary, announced a campaign against environmental crimes, specifically the black market trade in ozone depleting substances. *Id.* As of late 1996 there have been no seizures of illegal CFC shipments nor have any arrests been made. *Id.*

[109] Elisabeth Tacey, *Black Market Blooms in CFCs*, SOUTH CHINA MORNING POST, Oct. 2, 1995, at 6. Taiwan seems to be experiencing the most severe problem; in March of 1996 customs officials seized 40 tons of mislabled CFCs, destined to be used in automobiles and commercial refrigeration and air-conditioning equipment. *See Case Study*, *supra* note 90, at 17. Although Taiwan is not a party to the Montreal Protocol due to China's objections to its status as an independent nation, the Taiwanese government stated that it will actively comply with the Protocol's phaseout schedule for Article Two countries. *Id.* at 12. The situation in southeast Asia is quite similar to that occurring at the U.S.-Mexican border: due to the close proximity of an Article Five country which continues to produce legal CFCs (in this case, China, which is currently the world's largest CFC producer), neighboring Article Two countries are experiencing sharp increases in illegal imports.

B. Implications

The black market trade in CFCs is of great concern for several reasons. Perhaps the most obvious effect of the black market is the direct harm that the illegal CFCs inflict upon the earth's ozone layer. All scientific studies and projections which underlie the Protocol's restrictions assume 100 percent compliance with the production and consumption quotas set for each country.[110] Currently, scientists predict that the ozone layer will fully recover around 2045, based upon total compliance with Protocol restrictions.[111] While legal production and consumption of CFCs declines worldwide, illegal CFCs make up an increasingly larger share of the total market.[112] These illegal substances are certain to delay the ozone layer's recovery and increase the earth's risk of biological harm from ultraviolet rays.[113]

In addition to the harm the illegal CFCs inflict upon the ozone layer, the black market threatens to undermine the foundation of the Protocol itself. As previously emphasized, the Protocol depends upon an intricate system of market incentives and cooperation among participating nations.[114] The development and use of CFC substitutes was essential to both producer and consumer support of the phaseouts, and will ultimately determine the success of the agreement. While the CFC industry has largely performed its obligation under the Protocol to develop and market ozone-friendly alternative refrigerants, consumers have generally been reluctant to convert to the new substances. It is estimated that chemical companies have invested several billion dollars in the research and development of alternative refrigerants.[115] However, due to continuing demand for ozone-depleting CFCs in developed countries, demand for the new refrigerants has been much lower than anticipated and chemical companies are not seeing

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[110] *Deadly Complacency*, *supra* note 83, at 6.

[111] *Id.*

[112] Chemical industry representatives estimated that by late 1995 up to 20 percent of CFCs in use around the world were purchased on the black market. THE ECONOMIST, Dec. 9, 1995, at 89. Experts say that smuggled CFCs may be supplying as much as 30 percent of the continuing U.S. market for the refrigerant. Hamilton, *supra* note 76.

[113] Hamilton, *supra* note 76.

[114] *See supra* text accompanying notes 46-53.

[115] *See* Hamilton, *supra* note 76. ICI Americas, Inc. has invested over $500 million worldwide to develop a substitute for CFC-12, while DuPont has invested about $500 million as well. *Id.*

significant returns on their investments.[116] Believing that there are unlimited supplies of moderately priced CFCs, both individual and commercial users do not see the need to retrofit their air conditioning systems to handle the new ozone-friendly substances.[117] Refrigerant manufacturers who comply with the law are penalized, in that it becomes increasingly difficult for them to remain profitable against black market products. Ultimately, the black market undermines the confidence of those industries and countries which have complied with both the letter and spirit of the Protocol.

Perhaps most distressing are the black market's ramifications for future multilateral environmental agreements. Persuading nation-states to take action on transboundary environmental problems has always been remarkably difficult. Moreover, in the rare event that multilateral action is undertaken, success ultimately depends upon the parties' desire and ability to implement and enforce the agreement made. Given the difficulty Protocol signatories are experiencing in the implementation and enforcement of an agreement which regulates only a small variety of products, future attempts to address more complex global environmental issues are certain to present greater problems.[118] For these reasons, it is imperative that the black market trade

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[116] According to Jean-Bernard Lartigue, Executive Vice President of Elf Autochem, the CFC substitutes have been unprofitable partly due to overcapacity in production facilities, and partly because the illegal imports of CFCs have delayed the use of substitutes in the market. Michael Roberts and Ian Young, *Rise in Illegal CFCs Dogs HFC producers*, CHEMICAL WEEK, Nov. 22, 1995, at 18.

[117] Furthermore, smuggled CFCs which avoid the U.S. excise tax are pulling down the price of stockpiled CFCs which were produced before the phaseout, often times driving the legitimate product from the market entirely. Indeed, consumers seldom know whether they are getting the legal or illegal product. Charles J. Hanley, *Smugglers Ship Banned Freon to U.S.; Loophole Enables Older American Cars to Get CFCs for Air Conditioning*, AUSTIN AMERICAN-STATESMAN, March 31, 1996, at D-1.

[118] As Duncan Brack notes:

> No one doubts that there will be more environmental treaties in the future. The international community will increasingly find itself applying controls to the production, use and movement of products and substances which cause pollution. There will always, therefore, be an incentive for black markets to arise. If the problem cannot be tackled in the case of ozone-depleting substances, which are quite limited in number and volume, then this will be a clear signal to those inclined to operate in illegal markets, that environmental crime is not taken seriously.

Duncan Brack, remarks at *Combating Environmental Crime: U.K. Department of Environment Seminar*, Oct. 16, 1996 (transcript available from the Royal Institute of International Affairs).

in CFCs be dealt with accordingly.

C. *Solutions*

As a result of these important concerns, the black market trade in CFCs has recently been the subject of much debate among scientists and international policy-makers. At the Seventh Meeting of the Parties to the Montreal Protocol in Vienna in 1995, Protocol signatories directed the Ozone Secretariat to compile information on the black market trade and report back at the Eighth Meeting of the Parties the following year.[119] Although the vast majority of those who have an interest in the Protocol's success agree that the black market problem must be addressed, there is a significant divergence of opinion on the means to be employed.

One approach, advocated by the Alliance for Responsible Atmospheric Policy (hereinafter Alliance),[120] proposes that the black-market trade should be addressed mainly through stricter enforcement of the current regime.[121] On a domestic level, this would be accomplished by devoting increased resources to monitoring imports and exports of CFCs which are permitted under the Protocol. On the international level, the Alliance proposes that Protocol signatories should coordinate enforcement efforts and share the experiences of their governments in curtailing illegal activity.[122] In this regard, the Alliance suggests that parties should be strongly urged to enforce the Protocol's production rectrictions, and should disallow further imports from countries which fail to comply with the agreement.[123] Finally, the Alliance recommends that parties to the Protocol should be encouraged to report imports and exports of new and recycled CFCs to the Secretariat, and

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For example, a future international treaty on greenhouse gasses and global warming would be substantially more complex than the Montreal Protocol, requiring the consideration of myriad economic and social issues, and potentially regulating thousands of major emissions sources.

[119] Decision VII/33 of the Parties to the Montreal Protocol, U.N. Envt'l Programme, U.N. Doc. EP/Oz.L.Pro7/12(1995.

[120] The Alliance is an industry coalition of about 500 producers and users of CFCs, which advocates international regulation of CFCs. See Benedick, *supra* note 11, at 32.

[121] *Alliance Urges Montreal Protocol Parties to Address Illegal CFCs*, Ozone Depletion Network Online Today (May 11, 1995), *available* in Westlaw, Allnews Database [hereinafter *Alliance Position*].

[122] *Id.*

[123] *Id.*

the Secretariat should periodically release compilations of these activities which could be verified and cross-checked by the parties themselves.[124]

On the other hand, some argue that nothing less than an immediate worldwide ban on CFC production is the only way the illegal trade can be effectively eliminated.[125] According to this view, the black market trade is simply a problem of supply and demand, and as long as CFCs continue to be legally produced in Article 5 countries, demand for the refrigerants in Article 2 countries will continue to drive illegal trade.[126] The proponents of this position argue that the few multinational chemical companies which continue to produce CFCs for export and use in Article 5 countries are exploiting loopholes in the Protocol, and are primarily responsible for the supply of illegal CFCs.[127] While the recent crack-downs on CFC smuggling are commendable, these proponents say, such efforts will never eliminate the black market trade.[128]

While both positions have their respective merits, each likewise has its respective drawbacks. Accordingly, it appears that the black market would most effectively be addressed by combining the best attributes of each position into an intermediate strategy. To illustrate, more stringent enforcement of the current Protocol restrictions is clearly necessary and would curtail illegal trade to some extent. However, the practical reality is that regardless of how much effort is devoted to enforcement, the black market will continue as long as CFCs remain abundant in some countries and scarce in others.[129] As such, measures to control the smuggling of CFCs

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[124] *Id.*

[125] *CFC Smuggler Arrests*, All Things Considered, National Public Radio (Transcript #97010901-212) Jan. 9, 1997, *available in* LEXIS, News Library, Curnws File. The environmental group Ozone Action argues that this approach is "vastly preferable (environmentally, economically, and bureaucratically) to the maze of taxes, essential use allowances, transformation credits, and reporting requirements" presently governing the CFC industry in the U.S. *Deadly Complacency*, *supra* note 83, at 7.

[126] *See Case Study*, *supra* note 90, at 1-3.

[127] *Id.* The "loopholes" to which the allegation refers are the Protocol's two tier phase-out regime, and the provision which allows for continued CFC production in industrial countries for export to developing countries which are subject to the delayed phase out deadline.

[128] *Id.* at 15.

[129] As Jim Vallette writes: "Smugglers can adapt to any condition except one: the absence of supply. In other words, this black market will end only when the world's last CFC factory turns off its valves." *Id.* at v. The international drug trade is a prime example of this predicament: While the U.S. and other countries have spent tens of billions of dollars in the "War on Drugs," international drug smuggling has continued largely unabated.

without a corresponding effort to eliminate production are simply inadequate. The Alliance position cautions against eliminating worldwide production for several valid and important reasons. To begin with, the current structure of the Protocol has inevitably created some tension between industrialized and developing nations due to the delayed phase-out of CFC production granted to developing countries.[130] Besides the fact that many Article 5 nations would vehemently oppose an attempt to accelerate the 2010 deadline,[131] a complete ban on the production of CFCs is likely to result in *de facto* non-compliance by developing nations.[132]

Although such an attempt to advance the Protocol's phase-out deadline would almost certainly be unsuccessful, there exists a more practical method through which the worldwide elimination of CFC production might be hastened. The Protocol's Multilateral Fund,[133] which was designed to cover developing countries' incremental costs in switching to alternative refrigerants, has been effectively used to provide incentives for many developing nations to accelerate their phase-out deadlines under the agreement. After several years of problems in Fund administration, the Protocol's Implementation Committee appears to have shaped the Multilater-

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[130] *See supra* notes 51-53. Developing nations recently complained that Article 2 nations are violating the spirit of the Protocol through the "dumping" of "obsolete technology," namely air conditioning and refrigeration equipment using CFCs. *Montreal Protocol Vienna Meeting Nearly Collapses at 11th Hour*, AIR CONDITIONING, HEATING & REFRIGERATION NEWS, vol. 197, no. 11, Pg. 14 (March 11, 1996). These countries argue that this "technology dumping" is increasing their dependence on ozone-depleting CFCs, while at the same time, they are required by the Protocol to phase out the refrigerants.

[131] At the 1995 Meeting of the Parties in Vienna, a group of developing nations, led by India, even argued for the adoption of a "service tail" which would allow developing countries an additional ten to twenty years to phase out production of CFCs. Senthil Ratnasabapathy, *Hard Bargaining, Partial Success in Ozone Debate*, INTER PRESS SERVICE, Dec. 7, 1995, *available in* LEXIS, News Library, Curnws File. After an intense debate, the Indians dropped the proposal. *Id.*

[132] The Alliance notes that the production of CFCs is a low-tech process, and further restricting CFC availability to developing countries would undoubtedly encourage these nations to build their own production facilities, thus eliminating compliance with the Protocol altogether. Kevin Fay, Counsel to Alliance for Responsible Atmospheric Policy, Testimony before Subcommittee on Energy and Environment of House Committee on Science, 102d Cong. (2d sess.) (1995) [hereinafter Fay Testimony].

[133] *See supra* notes 58-59 and accompanying text.

al Fund into a valuable tool in ozone layer protection.[134] Indeed, over 47 developing countries have expressed an intent to phase-out CFC use in advance of the 2010 deadline.[135] At the Eighth Conference of the Parties to the Montreal Protocol in Costa Rica in late 1996, developing countries firmly asserted that any requests for accelerated phase-out of CFCs must be met with a commensurate increase in contributions from industrial nations to the Multilateral Fund.[136] In response to this demand, Article 2 nations subsequently agreed to provide $540 million to the Fund for distribution between 1997 and 1999.[137] By continuing to provide proper funding for phase-out programs in developing countries, the industrialized world can take affirmative steps to permanently reduce the supply of ozone-depleting CFCs.

Experts agree that production of CFCs will eventually come to an end within the next ten to twenty years, regardless of whether the Protocol's phase-out deadlines are accelerated. In the interim period, however, trade restrictions and increased enforcement efforts are of paramount importance. In this regard, the Alliance position is fundamentally sound in several ways. First and foremost, it recognizes one of the fundamental premises behind the original Montreal Protocol, which is the need for international cooperation and regulation rather than a fragmented approach on the domestic level.[138]

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[134] *See* Edward A. Parson and Owen Greene, *The Complex Chemistry of the International Ozone Agreements*, ENVIRONMENT, vol. 37, no. 2, Pg. 16 (March 1995). Such problems included alleged "stinginess" in the contribution of funds by industrialized countries, and the funding of many dubious projects which had little or no effect in reducing developing countries' dependence on ozone-depleting substances. *Id.*

[135] *Case Study*, *supra* note 90, at 34. Specifically, the Fund is credited for reducing CFC production and demand in Mexico, as the country has announced it will ban domestic use of CFCs by the year 2000.

[136] Maricel Sequiera, *Treaties to Save Ozone Layer Stymied by Slow Payments*, INTER PRESS SERVICE, Nov. 27, 1996, *available in* LEXIS, News library, Curnws File.

[137] *Id.* Recently, the World Bank announced plans to use Protocol funds to assist in the shutdown of seven major Russian CFC plants by 1998. *Shutdown of Russian CFC Plants Will Help Latin America Phaseout, World Bank Says*, BNA INT'L ENV'T DAILY, Mar. 12, 1997. Bank officials stated that Russian CFC imports were keeping the price of CFCs low in Latin America, frustrating the efforts of those nations to switch to ozone-friendly alternative refregerants. *Id.* The Russian manufacturers represent nearly one-half of the world's CFC production capacity, and are believed to be a major source of the black market substances. *See supra* note 105 and accompanying text.

[138] *See Alliance Position*, *supra* note 121. The Alliance position takes into account the early success of the Protocol, and recognizes that an international black market trade should be dealt with on an international level.

Given the global nature of the ozone problem, unilateral actions on the part of any one country are often ineffective and sometimes even harmful.[139] At the Eighth Conference of the Parties in November 1996, the Protocol signatories adopted Decision VIII/17, which contained the Alliance's suggestions for the reporting of imports and exports of CFCs to the Protocol Secretariat, the establishment of an international "validation and approval" system for CFC shipments, and several other provisions designed to curtail the illegal trade in CFCs.[140] These multilateral enforcement efforts, combined with effective implementation at the national level, will clearly assist in providing a solution to the black market trade in CFCs.

V. CONCLUSION

Recently, NOAA reported that ozone levels in the northern hemisphere during 1996 were the worst on record.[141] Reductions of 20-25 percent were measured over Greenland, Northern Europe, and Siberia, with a 6 percent decrease in the ozone layer measured above the contiguous United States.[142] In addition, the WMO reported that the ozone hole above Antarctica has doubled in size over the past two years, and now covers twenty-two million square kilometers, approximately twice the size of Europe.[143] While distressing reports on the condition of the atmosphere continue to come in from the scientific community, there have also been recent indications that the provisions of the Montreal Protocol are beginning to work.[144] According to measurements taken at several sites around the globe, concentrations of ozone-destroying chlorine in the lower atmosphere

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[139] *See supra* notes 32-37 and accompanying text. For example, Germany recently adopted a law requiring industrial refrigerators containing CFCs to be emptied and refilled with ozone-friendly alternatives before 1998; however, the legislation failed to provide what should be done with the CFCs removed from the equipment. Nathan Stuart, *supra* note 83. If the chemicals are not destroyed, the law could potentially result in an additional 12,000 to 15,000 metric tons of CFCs on the European black market. *Id.*

[140] *See Group Calls For Greater Controls on Illegal Trade of CFCs*, BNA INT'L ENV'T DAILY, Dec. 2, 1996. Elizabeth Dowdsell, Executive Director of the United Nations Environment Program, and Undersecretary for the Montreal Protocol Secretariat, praised the enactment of Decision VIII/17 as a "significant step" in curbing the black market trade. *Id.*

[141] *Case Study*, *supra* note 90, at 19.

[142] *Id.*

[143] Maricel Sequeira, *supra* note 12.

[144] *See Fay Testimony*, *supra* note 132.

peaked in 1994 and have started to drop significantly.[145] Although it will be several more years before scientists can expect to see any recovery of the ozone layer itself, the downward trend in chlorine concentrations suggests general compliance with the Protocol.[146] Following these reports, experts predicted that the ozone layer could return to pre-CFC production levels by 2050.[147]

While the recent positive news is encouraging, the rise of the black market trade in CFCs threatens to undermine the Protocol's early success and further endanger the earth's ecology. Because this international effort in environmental diplomacy has been successful thus far, the Montreal Protocol should continue to serve as the primary basis for future efforts in ozone layer protection. Through the right combination of international and domestic trade regulations, and by utilizing the Protocol's Multilateral Fund to accelerate the worldwide phase out of ozone-depleting CFCs, the black market trade in CFCs can be eliminated. This would allow the Montreal Protocol to carry out the mission which its signatories intended.

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[145] *Effectiveness of Montreal Protocol in Stemming Ozone Loss Hailed by Scientists*, BNA INT'L ENV'T. DAILY, Sept. 25, 1996. *See also* Richard Monatersky, *Drop in Ozone Killers Means Global Gain; Total Concentrations of Chlorine and Bromine Compounds in the Lower Atmosphere Have Begun to Decline*, SCIENCE NEWS, March 9, 1996, at 151.

[146] Given that it takes several years for chlorine emissions to filter up to the stratosphere, the location of the ozone layer, scientists do not expect to see any signs of ozone layer recovery until around 2010. *Id.*

[147] *See* Monastersky, *supra* note 145.