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The Montreal Protocol: Confronting the Threat to Earth's Ozone Layer

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THE MONTREAL PROTOCOL: CONFRONTING THE THREAT TO EARTH'S OZONE LAYER

From a deep sleep, I slowly open my eyes and roll off my foam mattress—the foam padding made with chlorofluorocarbons ("CFCs").[1] *My feet touch the carpet—the underlay also made with CFCs. I stumble into the kitchen, to the refrigerator. With the summertime heat, the motor is working overtime. Its coolant, made of CFCs, is keeping my orange juice cold; the foam egg carton, also of CFCs, is keeping my eggs fresh. And there is my breakfast steak: resplendent in its CFC foam package.*

Time to get to work. Jumping into the car, I land in the CFC foam cushion seat, and switch on the CFC-cooled air conditioner. "I'm caught in a vicious cycle," I contemplate. "The more CFCs I use, the warmer the Earth's temperatures become because of the greenhouse effect. The warmer the greenhouse temperatures, the more I need this air conditioner. That means more CFCs."

I walk into my office building—the central air system using CFCs to cool the entire skyscraper. Before entering my office (the walls containing CFC insulation), and before turning on my computer terminal (made with CFC-cleaned semiconductors and chips), I turn first to pour a cup of coffee (into a CFC-made Styrofoam cup). Finally, I sit down to work, settling down, of course, in my CFC foam-padded chair.

I. MAGNITUDE OF THE CHLOROFLUOROCARBONS DILEMMA

A. The Contribution of CFCs to Stratospheric Ozone Depletion

According to scientific consensus, CFCs are depleting Earth's ozone layer, a twenty-mile belt of stratospheric gas that screens out harmful solar ultraviolet radiation (UV-B radiation).[2] The weakening of the ozone layer allows increasing quantities of ultraviolet radiation to

1. CFCs are human-made inert gases used originally as aerosol propellants in spray cans. Their various uses have grown steadily in recent years. Rising from the Earth, high into the stratosphere, CFCs set off chemical reactions that rapidly destroy life-protecting ozone. *Ozone Layer Depletion: Hearing Before the Subcomm. on Health and the Environment of the House Comm. on Energy and Commerce*, 100th Cong., 1st Sess. 2 (1987) [hereinafter *Ozone Layer Depletion*] (statement of Rep. Henry A. Waxman).

2. Ozone is the only gas in the atmosphere that prevents ultraviolet radiation from reaching Earth's surface. If compressed to surface pressure, ozone would be a layer only about one-eighth of an inch thick. *Id.* at 50 (statement of Dr. Robert T. Watson, Earth Science and Applications Div., Office of Space Science and Applications, National Aeronautics and Space Administration).

reach Earth's surface.[3] Recent ground-based and satellite measurements of ozone depletion show that, since 1969, the ozone layer has thinned by as much as three percent in northern latitudes.[4] The loss is more than six percent over parts of Alaska and Scandinavia in winter months, and as much as fifty percent over the Antarctic in springtime.[5]

Increased ultraviolet radiation resulting from ozone layer depletion will significantly affect life on Earth. If CFC emissions continue unchecked, the Environmental Protection Agency ("EPA") estimates the occurrence of a staggering 153 million additional nonmelanoma skin cancer cases among people either alive today or born before 2075.[6] About three million of these cases will be fatal.[7] In addition, increased UV-B radiation may impair human immune systems.[8]

The EPA also predicts disruption of the aquatic food chain.[9] Reduced productivity occurs among phytoplankton, an important link in the food chain, when exposed to increased UV-B radiation. Many higher life forms in aquatic systems are especially vulnerable in their larval stage. Reductions in commercially valuable fish catches will

3. Scientists estimate that for every one percent decline in atmospheric ozone, two percent more ultraviolet radiation reaches the Earth's surface. Shabecoff, *Most Authoritative Study Yet Shows Declining Ozone Layer*, N.Y. Times, Mar. 16, 1988, at A25, col. 3.

4. A 1988 report by the Ozone Trends Panel, sponsored by the National Aeronautics and Space Administration ("NASA"), found that ozone depletion over much of the United States, Canada, Western Europe, the Soviet Union, China, and Japan, was between 1.7% and 3% from 1969 to 1986. Global depletion, excluding that over the polar caps, was 2.6% from late 1978 through 1985. Rosewicz, *New Ozone Study Shows Depletion Exceeds Estimates*, Wall St. J., Mar. 16, 1988, at 58, col. 4.

5. Concentrations of chlorine in the polar vortex in the Antarctic indicate that CFCs do contribute importantly to an expanding Antarctic hole. Stolarski, *The Antarctic Ozone Hole*, 258 SCI. AM. 30, 36 (Jan. 1988).

6. Environmental Protection Agency, Protection of Stratospheric Ozone, 52 Fed. Reg. 47,489, 47,494 (1987) (to be codified at 40 C.F.R. pt. 82) (proposed Dec. 14, 1987) [hereinafter, EPA Proposed Rule].

7. *Id.* Each one percent drop in ozone levels could cause 10,000 more cases of skin cancer a year in the United States alone. Lemonick, *The Heat Is On*, TIME, Oct. 19, 1987, at 58, 60. Such increases could include five percent more squamous skin cancers and two percent more cases of melanoma. Melanoma currently claims 5000 American lives annually. Beck & Hager, *More Bad News for the Planet: A Grim Report on the Ozone*, NEWSWEEK, Mar. 28, 1988, at 63.

8. UV radiation reduces the ability of the immune system to respond adequately to antigens, reducing the body's ability to fight the development of tumors, and may increase the frequency of outbreak of herpes simplex virus and leishmaniasis (a skin disorder common in the tropics). EPA, REGULATORY IMPACT ANALYSIS: PROTECTION OF STRATOSPHERIC OZONE, VOL. I: REGULATORY IMPACT ANALYSIS DOCUMENT 7-11, 7-24 (1987) [hereinafter EPA, REGULATORY IMPACT ANALYSIS].

9. EPA Proposed Rule, *supra* note 6, at 47,495.

result from the reduction in food supplies at the base of the food chain.[10]

Scientists also expect mutations of plant life, including food sources.[11] Plants that have been exposed to supplemental UV radiation in greenhouse chambers have shown up to a twenty-fold increase in the frequency of mutations.[12]

Two types of compounds, CFCs and halons, are at the center of the ozone depletion crisis. CFCs are synthetic compounds of chlorine, fluorine, carbon, and sometimes, hydrogen. They are an industrial ideal: nontoxic, nonflammable, versatile, and economical.[13] Halons, containing bromine, are used primarily in fire extinguishers, and are especially destructive of stratospheric ozone.[14] CFCs and halons pervade many areas of our lives. In the United States alone, more than $135 billion worth of products that rely on CFCs are now in use.[15] According to EPA estimates, industries consumed 2.5 billion pounds of CFCs and halons worldwide in 1986: slightly more than half a pound for every person on the planet. In that same year, the United States used over 700 million pounds, almost three pounds per capita,[16] and approximately one-third of global CFC consumption.

Nearly all CFCs eventually leak into the atmosphere and collect there.[17] The most common CFCs have an atmospheric lifetime of 75

10. *Ozone Layer Depletion, supra* note 1, at 263 (statement of the International Environmental Community).

11. [1 The Summary Report] THE GLOBAL 2000 REPORT TO THE PRESIDENT OF THE U.S.: ENTERING THE 21ST CENTURY 87–88 (1980).

12. UV-B radiation is energetic enough to break apart biological molecules, including DNA. *Id.* at 87 (quoting NATIONAL ACADEMY OF SCIENCES, ENVIRONMENTAL IMPACT OF STRATOSPHERIC FLIGHT: BIOLOGICAL AND CLIMATIC EFFECTS OF AIRCRAFT EMISSIONS IN THE STRATOSPHERE 11 (1975)).

13. Koenig, *Search for Substitutes for Refrigerants Shows Some Progress but Has Far to Go*, Wall St. J., Mar. 28, 1988, at 6, col. 1.

14. EPA Proposed Rule, *supra* note 6, at 47,491.

15. Monastersky, *Decline of the CFC Empire*, 133 SCI. NEWS 234 (1988). In the United States, CFCs are used by some 5000 businesses at nearly 375,000 locations to produce goods and services worth more than $28 billion a year. ALLIANCE FOR RESPONSIBLE CFC POLICY, CHLOROFLUOROCARBONS: THE CASE FOR RESPONSIBLE POLICY 5 (1987). Many of the essentials of modern life contain CFCs, including refrigerators and freezers, home and automobile air conditioners, and the cooling systems of every public and commercial building. CFCs form the uniform-sized bubbles of foams used in food packaging, furniture cushions, and home insulation. They are also used as cleaning solvents for microelectronics and for sterilizing medical equipment. *U.S. Participation in International Negotiations on Ozone Protocol: Hearing Before the Subcomm. on Human Rights and Int'l Orgs. of the House Comm. on Foreign Affairs*, 100th Cong., 1st Sess. 2 (1987) (statement of Rep. Jerry Solomon).

16. Monastersky, *supra* note 15, at 236.

17. For example, CFC emissions occur when aerosol cans are sprayed directly into the air, when CFCs escape from refrigerator coils, and when CFCs evaporate from liquid cleaners and plastic foams. Lemonick, *supra* note 7, at 62. More than 35 million tons of CFCs are currently

to 185 years.[18] Due to these long lifetimes, if all CFC production were to cease immediately, the ozone layer would still need over a century to replenish its past concentrations.[19]

CFCs are immune from destruction in Earth's lower atmosphere, the troposphere.[20] When they migrate slowly upward to the stratosphere, they encounter intense UV-B radiation which splits CFC molecules into their subparts—including chlorine. Once freed, chlorine attacks the ozone layer: small amounts of chlorine catalyze a chain reaction to destroy ozone.[21] Each chlorine atom released removes 100,000 molecules of ozone from the atmosphere.[22] The yearly release of approximately one million tons of CFCs—and the 100,000-fold chain reaction each chlorine atom creates—explains the extraordinarily destructive power of these artificial chemicals.[23]

B. The Contribution of CFCs to the Greenhouse Effect

Besides destroying the ozone layer, CFCs add substantially to global warming. While in the atmosphere, CFCs and other gases trap infrared radiation reflected from the Earth's surface, causing atmospheric temperatures to rise, and creating a "greenhouse effect."[24] The effects

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circulating in the atmosphere. United Nations Environment Programme, 1 N. AM. NEWS 2 (Dec. 1986) (statement of Peter Usher, UNEP meteorologist).

18. EPA Proposed Rule, *supra* note 6, at 47,498.

19. *Id.* at 47,489. For millennia, the process of ozone production and destruction has been more or less in equilibrium through ozone absorption of UV-B radiation. A molecule of ozone (O_3) is created when a photon of ultraviolet light strikes an oxygen molecule (O_2). The photon splits the molecule into two oxygen atoms (O). These atoms quickly combine with intact oxygen molecules to form ozone. Ozone readily absorbs ultraviolet light and dissociates into its component parts ($O_2 + O$). The freed oxygen atom subsequently joins with another oxygen molecule, reforming ozone. The gas continues to dissociate and reform many times in a dynamic steady-state. Stolarski, *supra* note 5, at 32.

20. EPA Proposed Rule, *supra* note 6, at 47,489.

21. Chlorine destroys the natural balance of ozone in the stratosphere by "stealing" ozone's third oxygen atom, converting ozone (O_3) into a chlorine monoxide radical (ClO) and oxygen (O_2). Radicals, which are molecules that have an odd number of electrons, are highly reactive. When the chlorine monoxide encounters a free oxygen atom ($ClO + O$), the oxygen in the chlorine monoxide molecule becomes highly attracted to the free oxygen atom and breaks away to form a new oxygen molecule (O_2, free Cl). The "abandoned" chlorine radical is free to begin ozone destruction anew. Stolarski, *supra* note 5, at 32–33.

22. Lemonick, *supra* note 7, at 62 (quoting Dr. F. Sherwood Rowland).

23. *Ozone Layer Depletion*, *supra* note 1, at 15–16 (statement of Prof. F. Sherwood Rowland, Dept. of Chemistry, Univ. of Cal. Irvine).

24. CFCs are one of the trace gases contributing to Earth's greenhouse warming. The greenhouse effect is perhaps the ultimate pollution problem, since Earth's biosphere can tolerate only a relatively narrow range of temperatures. The principal greenhouse gas is carbon dioxide. Atmospheric concentrations of carbon dioxide have grown by 30% since 1850, primarily due to the combustion of fossil fuels. N. MYERS, GAIA: AN ATLAS OF PLANET MANAGEMENT 116–17 (1984). As a result of increased atmospheric concentrations of carbon dioxide, global

of increasing atmospheric concentrations of greenhouse gases, including CFCs and carbon dioxide,[25] will include a sea-level rise of 20-140 centimeters,[26] submergence of coastal areas and estuaries, rainfall pattern disruption, permanent drought in entire agricultural regions[27] (including the American Midwest), aggravated deforestation,[28] and increased rates of species extinction.[29]

II. THE MONTREAL PROTOCOL

Curbing production of CFCs, halons, and related gases is an important first step in controlling greenhouse warming and in protecting all life forms from increased exposure to UV-B radiation. The Montreal Protocol ("Protocol") is the culmination of initial steps taken by the international community to mitigate the threat to both the ozone layer and Earth's climate posed by CFCs. Thirty-one nations signed the Protocol on September 16, 1987, and the United States ratified it on

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temperatures have risen by an estimated 0.5 degree centigrade. If atmospheric releases of carbon dioxide continue unchecked, preindustrial atmospheric levels of the gas will double by the year 2060, raising global mean temperatures from between 1.5 to 4.5 degrees centigrade. SCIENTIFIC COMMITTEE ON PROBLEMS OF THE ENVIRONMENT, THE GREENHOUSE EFFECT, CLIMATIC CHANGE, AND ECOSYSTEMS xxi (B. Bolin, B. Doos, J. Jager, & R. Warrick eds. 1986) [hereinafter SCOPE, THE GREENHOUSE EFFECT].

25. The contribution of greenhouse gases other than carbon dioxide—including CFCs, methane, and nitrous oxide—"is already about as important as that of CO_2." LESTER BROWN, STATE OF THE WORLD: 1987, at 162 (1987). Each CFC molecule absorbs 10,000 times more infrared radiation than carbon dioxide. *Ozone Layer Depletion, supra* note 1, at 10 (statement of Dr. Rowland). Trace gases other than carbon dioxide account for about one-sixth of the current stock of greenhouse gases in the atmosphere, and CFCs are increasing more rapidly than the other trace gases. *Id.* at 253 (statement of David A. Wirth, Senior Project Attorney, Natural Resources Defense Council ("NRDC")). The rising concentrations of greenhouse gases could have the same effect as a doubling of carbon dioxide over preindustrial levels by as early as the 2030's. SCOPE, THE GREENHOUSE EFFECT, *supra* note 24, at xxi.

26. *Id.* at xxii. As the oceans warm and expand, melting polar ice caps, water could inundate 11.5% of Bangladesh's land area where eight million people now live. A sea-level rise of this magnitude could also cause "saltwater intrusion into freshwater resources, widespread destruction of wetlands by flooding, accelerated coastal erosion, and increased inland flooding during storms." *Ozone Layer Depletion, supra* note 1, at 264 (statement of the International Environmental Community).

27. *Id.* at 253 (statement of David A. Wirth, NRDC).

28. EPA Proposed Rule, *supra* note 6, at 47,495. Forests, wetlands, and wildlife have very little ability to adapt to increasingly hostile radiation and climate. *Ozone Layer Depletion, supra* note 1, at 264 (statement of the International Environmental Community); *see also* [1 Executive Summary] EPA, OFFICE OF AIR AND RADIATION, ASSESSING THE RISKS OF TRACE GASES THAT CAN MODIFY THE STRATOSPHERE ES-49 (Dec. 1987) [hereinafter EPA RISK ASSESSMENT] ("[i]f current [climate] predictions prove accurate, there is a potential for dramatic shifts in forests and vegetation over the next 100 years.").

29. EPA Proposed Rule, *supra* note 6, at 47,495.

March 14, 1988.[30] International negotiations commenced in 1981 under the auspices of the United Nations Environment Programme ("UNEP"). In March 1985, twenty-one countries and the European Economic Community adopted a Convention for the Protection of the Ozone Layer in Vienna.[31] The Vienna Convention provided for international cooperation in research, monitoring, and information exchange. It created a framework for the adoption of international regulatory measures.[32] Subsequently, sixty-two countries negotiated limits to the use of ozone-depleting CFCs and halons, resulting in the Montreal Protocol.[33]

The Protocol's entry into force is not certain. Prior to January 1, 1989, at least eleven nations responsible for two-thirds of 1986 levels of CFC production must ratify the agreement.[34] If the target date is not met, the Protocol will enter into force ninety days after these ratification conditions are fulfilled.[35]

The Protocol contains four key provisions. First, it requires parties to freeze, and eventually reduce, their production and consumption of CFCs and halons.[36] Second, parties must periodically reassess scientific, environmental, technical, and economic data to revise the reduction requirements.[37] Third, the Protocol encourages less developed countries ("LDCs") to join the agreement and assists LDC parties in developing CFC substitutes.[38] Fourth, the Protocol imposes restrictions on trade of ozone-depleting products with nonparties in order to encourage nonparties to sign.[39] The substantive measures aimed at achieving the Protocol's four key provisions invite scrutiny and analysis in light of recent scientific data on the extent of ozone depletion.

30. Rosewicz, *U.S. Ratifies Treaty to Curb Chemicals Depleting Ozone Layer in Atmosphere*, Wall St. J., Mar. 15, 1988, at 28, col. 3.

31. United Nations Environment Programme, *The Changing Atmosphere*, 1 ENVIRONMENT BRIEF 7 (1987). The United States ratified the Convention in August 1986. H.R. REP. NO. 176, 100th Cong., 1st Sess., pt. 1, at 2 (1987).

32. EPA Proposed Rule, *supra* note 6, at 47,491.

33. United Nations Environment Programme, 2 N. AM. NEWS 1 (1987).

34. Montreal Protocol on Substances that Deplete the Ozone Layer, *opened for signature* Sept. 16, 1987, art. 16, *reprinted in* 26 I.L.M. 1541, 1559–60 (1987) [hereinafter Montreal Protocol].

As of August 1, 1988, two countries, the United States and Mexico, had ratified the Montreal Protocol. Rosewicz, *supra* note 30, at 28, col. 3.

35. EPA Proposed Rule, *supra* note 6, at 47,496.

36. Montreal Protocol, *supra* note 34, art. 2, *reprinted in* 26 I.L.M. at 1552–53.

37. *Id.*, art. 6, *reprinted in* 26 I.L.M. at 1556.

38. *Id.*, art. 5, *reprinted in* 26 I.L.M. at 1555–56, art. 9, *reprinted in* 26 I.L.M. at 1556–57, art. 10, *reprinted in* 26 I.L.M. at 1557.

39. *Id.*, art. 4, *reprinted in* 26 I.L.M. at 1554–55.

A. Control Provisions: Reducing CFC Output

1. Establishing Baseline Reductions

When the Protocol enters into force, parties must freeze production and consumption of CFCs at 1986 levels, reduce these levels twenty percent by 1993, and reduce them an additional thirty percent of 1986 levels by 1999.[40] In this way, the Protocol will accomplish a fifty percent reduction in production and consumption of CFCs over the next ten years. The Protocol will also freeze halon production and consumption at 1986 levels beginning in 1992.[41]

The Protocol's control provisions divide CFCs and halons into separate groups for purposes of regulation.[42] Producers may manufacture any mix of chemicals within each group up to a maximum limit set by their 1986 baseline production level.[43] Producers determine which CFCs or halons to produce and how to stay within the maximum production or consumption limits.[44]

Article 1 of the Protocol defines production as "the amount of controlled substances produced minus the amount destroyed by technologies to be approved by the Parties."[45] It also defines consumption as "production plus imports minus exports of controlled substances."[46] Thus, although the Protocol classifies exports as part of production, it does not include exports in calculated consumption levels. As a result, a producer's exports appear on the importing country's quota. Article 3 provides that after January 1, 1993, producers may not subtract from their consumption levels any export of controlled substances to nonparties.[47] Firms may trade their allocated quotas.[48]

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40. *Id.*, art. 2, *reprinted in* 26 I.L.M. at 1552–53.

41. *Id.*

42. *Id.* Group I includes CFC-11 (with an atmospheric lifetime of 75 years), CFC-12 (111 years), CFC-113 (90 years), CFC-114 (185 years), and CFC-115 (380 years). EPA Proposed Rule, *supra* note 6, at 47,496. Group II controlled substances include Halon-1211 (atmospheric lifetime of 25 years), Halon-1301 (110 years), and Halon-2402 (atmospheric lifetime not reported). *Id.* at 47,498.

43. Montreal Protocol, *supra* note 34, art. 2, *reprinted in* 26 I.L.M. at 1552.

44. EPA Proposed Rule, *supra* note 6, at 47,496.

45. Article 1 allows fresh production to replace those amounts of CFCs and halons destroyed. The provision aims to encourage the development of destruction technologies. Montreal Protocol, *supra* note 34, art. 1, *reprinted in* 26 I.L.M. at 1551.

46. *Id.*

47. *Id.*, art. 3, *reprinted in* 26 I.L.M. at 1554.

48. *Id.*, art. 2, *reprinted in* 26 I.L.M. at 1553.

2. *Improving Control Provisions with Assurance of Good Faith Reporting*

Data collection to prescribe accurate baselines is critical under the Protocol.[49] Because regulated supplies may inflate CFC prices, manufacturers have an incentive to exaggerate their original baseline level of CFC production. However, the Protocol does not provide sanctions for inaccurate baseline calculations, nor does it sanction inaccurate ongoing production and consumption figures.[50]

UNEP could revise the Protocol to assure good faith reporting. The revision could punish misreports of baseline or ongoing production levels with trade sanctions.[51] Parties who fail to sanction their domestic industries for incomplete or inaccurate data could incur trade sanctions for violating the reporting requirements of the Protocol.[52]

B. Provision for Renegotiation and Scientific Review

1. The Protocol's Review Requirements

The Protocol's review provision calls for renegotiation of control measures in light of current data. Beginning in 1990, and at least every four years thereafter, parties must meet to reassess the control provisions on the basis of available scientific, environmental, technical, and economic information.[53] Parties may adjust the control levels and substances covered by the Protocol. The Protocol also requires panels of experts in relevant fields to issue reports on new data prior to each assessment.[54]

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49. The secretariat of UNEP is charged with data collection from and monitoring of all parties to the Protocol. Montreal Protocol, *supra* note 34, art. 7, *reprinted in* 26 I.L.M. at 1556. Because the Protocol is not specific concerning the form of monitoring, Article 7 could be amended to include provision for verification of annual production figures. Verification could include plant inspections, and direct examination of producers' records of production, imports, and exports. Verification efforts will require an expanded UNEP staff and budget.

50. Article 8 schedules consideration of non-compliance measures for the first meeting of the parties after the Protocol is ratified. Montreal Protocol, *supra* note 34, *reprinted in* 26 I.L.M. at 1556.

51. Trade control under the Protocol would be in accordance with Article XX, paragraph (b) of the General Agreement on Tariffs and Trade ("GATT") concerning the protection of human, animal, or plant life or health. United Nations Environment Programme, *Report of the Ad Hoc Working Group on the Work of its Third Session* 18, U.N. Doc. UNEP/WG.172/2 (1987) (copy on file at *Washington Law Review*). *See* General Agreement on Tariffs and Trade, Oct. 30, 1947, art. XX, 61 Stat. pt. 5 at A-60–61, T.I.A.S. No. 1700, 55 U.N.T.S. 194.

52. International sanctions on non-complying parties could include initial tariffs on imports of bulk controlled substances and on products containing or manufactured with CFCs, followed by an outright ban on these imports where tariffs are ineffective.

53. Montreal Protocol, *supra* note 34, art. 6, *reprinted in* 26 I.L.M. at 1556.

54. *Id.*

2. *Improving the Review Provision with an Immediate Reassessment Requirement*

Recent research now confirms global ozone depletion and shows that even the short-term situation is serious. The control provisions thus require immediate reassessment. Accordingly, UNEP could revise the Protocol to allow for renegotiation at any time warranted by new information.[55] Parties negotiated the original 1990 policy review date and control provisions before confirmation that CFCs seriously deplete the ozone layer.[56] Furthermore, scientists predict that even the Protocol's fifty-percent-over-ten-year reduction in CFC production will result in nine-percent depletion of the ozone layer over present depletion levels during the next seventy-five years.[57] Depletion of this magnitude could result in thousands of additional skin cancer cases and fatalities, as well as the breakdown of ecosystems.[58] Because of this need for immediate reassessment and the potential long delays between meetings of the parties, the Protocol could provide for immediate reassessment of control provisions as fresh data warrants.

C. *Provisions Concerning Less Developed Nations*

1. *Special Needs of the Less Developed Nations*

The Montreal Protocol addresses the equity concerns of Less Developed Nations.[59] LDCs and industrialized countries agree that LDCs are entitled to many consumer items and manufacturing processes that presently require CFCs.[60] The Protocol permits LDC parties with low

55. Article 11 of the Protocol allows for "extraordinary meetings" at times deemed necessary, subject to approval by one-third of the parties. Montreal Protocol, *supra* note 34, art. 11, *reprinted in* 26 I.L.M. at 1557–58. However, parties might stall meetings by continually requesting further scientific study. UNEP could amend Article 11 to include a trigger mechanism for extraordinary meetings. UNEP could authorize a panel of data experts under Article 6 to include an international cross-section of scientists, policymakers, and industry representatives. The panel could be charged with scheduling meetings of the parties where data of increased incremental depletion warrants immediate attention.

56. Shabecoff, *supra* note 3, at A25, col. 6.

57. S. Res. 226, 100th Cong., 1st Sess., 134 CONG. REC. S2114 (1988).

58. *See supra* notes 6–12 and accompanying text. Although many deem the Protocol a "crucial first step" in combating the ozone problem, Dr. Sherwood Rowland, who with Dr. Mario Molina discovered that CFCs deplete ozone, emphasizes that "it ought to be the first step in a sprint, not leisurely steps 10 years at a time." Beck & Hager, *supra* note 7, at 63 (quoting Dr. Rowland).

59. The Protocol emphasizes that "special provision is required to meet the needs of developing countries for these substances." Montreal Protocol, *supra* note 34, preamble, *reprinted in* 26 I.L.M. at 1551.

60. The concerns of LDCs include those expressed by the People's Republic of China, emphasizing that the current demand in China for refrigerators requires expansion of the Chinese CFC industry. United Nations Environment Programme, *supra* note 33, 2 N. AM.

levels of CFC use per capita to delay their compliance with the Protocol for up to ten years.[61] The Protocol facilitates LDC access to alternative substances and technologies.[62] Resolution Two of the Protocol calls for creation of a system of international cooperation to make technological information available to all parties.[63] The Resolution authorizes the Executive Director of UNEP to make "appropriate arrangements" to facilitate the exchange of information on technologies and administrative strategies for Protocol implementation. Industrial parties will provide LDC parties with subsidies, credits, guarantees, or insurance programs toward alternative technologies and substitute products during the ten-year exemption period.[64]

2. *Improving LDC Provisions Through Monitoring Data and Facilitating Transfer of CFC Substitutes*

Due to the permitted ten-year delay in compliance, LDCs might circumvent the phasedown and per capita limits of the Protocol. Requiring LDC parties to submit annual data concerning imports and exports of controlled substances, and monitoring by the UNEP secretariat of construction of new CFC production and use facilities, could close this potential loophole.[65]

Providing alternatives to LDC parties will help discourage construction of new CFC or halon production facilities in LDCs. Amending the Protocol to ensure access to information on substitute chemicals and recycling technology could further this goal. UNEP could require parties implementing the Protocol to develop domestic assistance programs to subsidize the transfer of substitute technologies to LDC parties. Such a plan could avoid the development of an information monopoly by specific countries.[66]

NEWS at 2. The Protocol allows the Soviet Union, a relatively developed country, to complete production of CFC manufacturing facilities previously written into its current five-year plan. *Tentative Pact to Protect Earth's Ozone*, San Fran. Chron., Sept. 16, 1987, back page, col. 6.

61. The Protocol imposes a ceiling on per capita consumption of CFCs and halons of 0.3 kilograms during the 10-year period. Montreal Protocol, *supra* note 34, art. 5, *reprinted in* 26 I.L.M. at 1555.

62. *Id.*, art. 10, *reprinted in* 26 I.L.M. at 1557.

63. *Id.*, res. 2, *reprinted in* 26 I.L.M. at 1548.

64. *Id.*, art. 5, *reprinted in* 26 I.L.M. at 1556.

65. UNEP verification measures could directly monitor the 0.3 kilogram per capita limit. Where verification reveals excesses, the LDC party could incur trade sanctions. *See supra* notes 49– 52 and accompanying text. Aid credits and subsidies could be tied to Protocol compliance.

66. UNITED NATIONS ENVIRONMENT PROGRAMME, REPORT OF THE *Ad Hoc* WORKING GROUP ON THE WORK OF ITS THIRD SESSION, *supra* note 51, at 6.

International cooperation could take the form of bilateral and multilateral development assistance.[67] Industrial nations could coordinate efforts to transfer substitutes and appropriate technologies to the LDCs. National assistance programs, such as the United States Overseas Private Investment Corporation ("OPIC"), could coordinate licensing, export credits, and development assistance for alternative technologies as they become commercially available.[68] Such efforts may require legislation mandating the transfer to LDC parties of information on toxicology tests, substitute chemicals, technology for producing alternatives, and product retrofitting.[69] International assistance will be a major consideration when LDC governments decide whether to forgo outmoded, harmful technologies in favor of environmentally superior alternatives.

D. Trade Provisions

1. Import and Export Restrictions

The Protocol bans imports, by a party, of bulk CFC and halon chemicals from any nonparty beginning one year after the treaty becomes effective.[70] No party may export the bulk chemicals to nonparties.[71] Within three years of the Protocol's entry into force, parties will determine whether it is feasible to control trade of products manufactured with CFCs, and may then ban or restrict the import of products produced with CFCs from any nonparty.[72] Furthermore, parties

67. D. DONIGER, NATURAL RESOURCES DEFENSE COUNCIL, WRITTEN STATEMENT AT THE PUBLIC HEARING ON STRATOSPHERIC PROTECTION 27 (Jan. 7, 1988) (copy on file at *Washington Law Review*).

68. *Id.* In the industrialized countries, fourteen CFC producers have joined in an effort to speed substitute production through cooperating in toxicology testing and sharing test costs. Monastersky, *supra* note 15, at 235. Development assistance programs could make available the results of these tests to LDC parties. This would serve as a first step in transferring substitute technology, and as an incentive for LDC nonparties to join the Protocol.

69. Development assistance could include subsidy programs for the transfer to LDC parties of licenses on patented alternative technologies and substitutes.

70. Montreal Protocol, *supra* note 34, art. 4, *reprinted in* 26 I.L.M. at 1554.

71. The Protocol controls "bulk" chemicals but does not, initially, control "products" containing or manufactured with CFCs or halons. Because parties can evade the initial "bulk" controls by packaging the chemicals in "product" containers, UNEP could establish specific differentiation standards. Differentiation could focus on the size, rechargeability, and primary purpose of the storage or transport container. Where the container is rechargeable and has a retail end-use, it could be classified as a "product." Otherwise, the container could be subject to more immediate control under the "bulk chemical" category. UNITED NATIONS ENVIRONMENT PROGRAMME, NOTE BY THE EXECUTIVE DIRECTOR OF UNEP paras. 37–40, Doc. UNEP/WG.185/3 (1988) (copy on file at *Washington Law Review*).

72. Parties are scheduled to meet three years after the Protocol's entry into force to draft an annex to the Protocol listing products containing controlled substances. After the annex becomes effective, parties who do not object to the contents of the annex will ban the import of

will "discourage" the export to nonparties of technologies for producing and utilizing controlled substances.[73] Moreover, the Protocol restricts parties from providing new subsidies, aid, credits, guarantees, or insurance programs for the export to nonparties of products, equipment, plants, or technology that would facilitate the production of controlled substances.[74]

In order to accomodate LDC needs, the Protocol permits producers in industrial countries to increase production ten percent above baseline levels so long as the excess is for export to LDC parties.[75] The rationale of this provision is to discourage LDCs from constructing new CFC production facilities while guaranteeing these countries their "basic domestic needs" of CFCs and halons until substitutes are available.[76]

2. *Improving Trade Provisions By Restricting CFC Exports to LDC "Basic Domestic Needs"*

A requirement that industrial countries certify their exports to LDCs, restricting use to the "basic domestic needs" of the LDCs, could prevent abuse of the trade provisions. During the first three years following the Protocol's entry into force and prior to development of the Protocol's commodity control annex,[77] LDCs could abuse the added production provisions. For example, an LDC could import bulk CFCs from an industrialized nation under the ten-year compliance delay (and under the industrial country's grant of added production privileges) and then re-export finished products containing CFCs. LDCs could also use the imported CFCs for plainly nonessential uses

listed products from nonparties within one year. Montreal Protocol, *supra* note 34, art. 4, *reprinted in* 26 I.L.M. at 1555.

73. The Protocol is not specific with regard to the procedure for "discouraging" export to nonparties. If consultations instigated by the secretariat fail to stop the practice of trade with nonparties, the secretariat could call upon other parties to impose trade sanctions on the culprit.

74. Montreal Protocol, *supra* note 34, art. 4, *reprinted in* 26 I.L.M. at 1555.

75. Both Article 2, Paragraph 1 (10% additional production for exports to LDC parties), and Article 5, Paragraph 1, (10-year delay available to LDC parties), refer to the "basic domestic needs" of LDCs. Although the intent is to limit LDCs to their internal needs and not to allow CFC production expansion for the purpose of supplying other countries, this provision could be clarified. UNITED NATIONS ENVIRONMENT PROGRAMME, NOTE BY THE EXECUTIVE DIRECTOR OF UNEP, *supra* note 71, at paras. 28–32.

76. Montreal Protocol, *supra* note 34, art. 2, *reprinted in* 26 I.L.M. at 1552–53. To prevent abuse of the special provisions for LDCs, the definition of "basic domestic needs" could be limited to essential uses for CFCs and halons. Essential uses could include those with no available substitutes, with priority given to medical uses.

77. Montreal Protocol, *supra* note 34, art. 4, *reprinted in* 26 I.L.M. at 1555. *See supra* note 72 for a description of the commodity control annex.

such as aerosol propellants or foam packaging.[78] In order to avoid such abuse, embassies of industrialized countries located in the LDCs could certify CFC imports by requiring a prior license. These licenses could confirm that the LDC is engaged in only "essential uses" of CFCs and halons.[79]

III. UNITED STATES DOMESTIC REGULATIONS FOR PROTECTING STRATOSPHERIC OZONE

The Environmental Protection Agency has promulgated a rule for domestic compliance with the Montreal Protocol under the authority of Section 157(b) of the Clean Air Act.[80] The EPA's rule follows the Protocol's control provisions, including the fifty-percent reduction in CFC production over ten years.[81] Because stratospheric ozone depletion has reached dangerous levels, however, the EPA could go further than the Protocol and implement strict standards. The Clean Air Act mandates regulations sufficient to protect the public health and welfare against reasonably anticipated dangers.[82]

A. EPA Authority Under the Clean Air Act

The EPA has an independent legal obligation under the Clean Air Act to regulate domestic CFC and halon use to protect the stratosphere. The Clean Air Act requires the EPA to take the lead in developing provisions to protect the stratosphere from ozone depletion. Section 157(b) of the Clean Air Act states that

> [The EPA's Administrator] shall propose regulations for the control of any substance, practice, process, or activity (or any combination thereof) which in his judgment *may reasonably be anticipated to affect* the stratosphere, especially ozone in the stratosphere, if such effect in the stratosphere *may reasonably be anticipated to endanger* public health or welfare. Such regulations shall take into account the feasibility and the costs of achieving such control.[83]

78. D. DONIGER, *supra* note 67, at 26. UNEP could establish a list of essential uses evaluated under the criteria listed *infra* at note 108.

79. *Id.*

80. Clean Air Act § 157, 42 U.S.C. § 7457 (1982).

81. The proposed rule will take effect in the United States only if the Montreal Protocol enters into force. EPA Proposed Rule, *supra* note 6, at 47,489. Because the EPA has an independent legal obligation to protect public health and welfare, regulations contingent on entry into force of the Montreal Protocol violate the Clean Air Act § 157(b), 42 U.S.C. § 7457(b) (1982).

82. Clean Air Act § 157(b), 42 U.S.C. § 7457(b) (1982).

83. *Id.* (emphasis added).

The Clean Air Act adopts a highly precautionary policy, charging the EPA with a legal duty to impose regulations when dangers are reasonably anticipated.[84]

1. The Severity of the Ozone Problem Requires a Stronger Approach

The severity of the ozone depletion problem calls for a stronger response from the EPA than that provided by the Protocol. The present level of CFCs and halons in the atmosphere has already caused serious ozone depletion.[85] The fifty percent CFC reduction called for under the Montreal Protocol—and thus under the proposed U.S. regulations—will increase rather than reduce global depletion of ozone, while atmospheric concentrations of these chemicals continue to grow indefinitely.[86] EPA research shows that an immediate cut in production of at least eighty-five percent is necessary to stabilize CFC concentrations in the atmosphere at current levels.[87]

2. More Stringent Control Provisions Are Feasible and Necessary for Domestic Industry

The EPA could step up the timing and magnitude of limits on CFC and halon production. Conservation has become the short-term answer as companies try to recycle or dilute CFCs, and the search for a permanent solution through substitutes is under way.[88] Du Pont,

84. According to the EPA's REGULATORY IMPACT ANALYSIS, the term "may reasonably be anticipated" "requires the Administrator to act if there is a reasonable probability that the stratosphere will be affected, and that the effects would endanger health or welfare." The term "any substance, practice, process, or activity" indicates that "[t]he scope of the Agency's authority is broad. It can regulate, for example, chemical production, use, and emissions in any relevant area." The term "affect the stratosphere" "grants authority for the EPA to act on other stratospheric concerns such as stratospherically-induced climate change." EPA, REGULATORY IMPACT ANALYSIS, *supra* note 8, at 3-10.

85. *See supra* notes 4–5 and accompanying text.

86. *See supra* note 57 and accompanying text. According to measurements by Dr. Sherwood Rowland, atmospheric levels of chlorine from CFCs were 1.8 parts per billion (ppb) in 1974; they have now reached 3.5 ppb and will rise to 5 ppb by the end of the century under the Montreal accord. Beck & Hager, *supra* note 7, at 63.

87. EPA RISK ASSESSMENT, *supra* note 28, at ES-5–6.

88. Monastersky, *supra* note 15, at 235. Fourteen chemical companies from eight nations are pooling toxicity test results in an effort to bring substitutes to market. *Scientific Findings Suggest Total Phaseout of Halogenated CFCs, Du Pont Tells Congress*, 12 Chem. Reg. Rep. (BNA) 11 (Apr. 1, 1988) [hereinafter *Scientific Findings Suggest Total Phaseout*]. American Telephone & Telegraph Company has pledged to switch from its use of CFC-113 as a cleaning solvent for computer circuit boards to an environmentally benign substitute. Stanfield, *A Can-Do Treaty*, 20 NAT'L J. 219 (Jan. 23, 1988). The food packaging industry, representing three percent of total CFC use, has pledged to stop using CFCs in the production of disposable foam cups, cartons, and food trays by the end of 1988. *End to Use in Food Packaging by 1989 Announced by Industry Group*, 12 Chem. Reg. Rep. (BNA) 78 (Apr. 15, 1988).

the world's largest CFC producer, has estimated that it could provide commercial substitutes in five to seven years.[89]

As the EPA implements regulations on CFCs and halons, industry investments to create new or improved uses will diminish.[90] Companies will channel research and development investment resources toward alternatives. Total demand for CFCs and halons will decrease, because new product designs will look to alternatives before incorporating CFCs.

The retail price of regulated CFCs and halons, however, will rise. Producers may reap windfall profits.[91] Producers may delay marketing substitutes where CFC profits remain high. Furthermore, user industries may hesitate to incur retrofitting costs for incorporating substitutes. Because CFC costs may be incidental to the total cost of products that incorporate CFCs, user industries may have an insufficient incentive to retrofit manufacturing processes away from CFCs. Regulation is thus essential to encourage producers to develop substitutes and users to retrofit plants to incorporate alternatives.

3. Unilateral Action by the United States

The United States could act unilaterally to accelerate the phaseout of CFCs and halons. The United States is responsible for one-third of global CFC production and use.[92] By phasing out production rapidly, it could significantly reduce CFC production while pressuring other countries to follow suit.

Under Section 157 of the Clean Air Act, the EPA has the authority to restrict the importation of goods manufactured with or containing

89. Early commercialization depends upon favorable interim toxicity tests. The completion of full, two-year tests will delay commercialization. JOSEPH M. STEED, E.I. DU PONT DE NEMOURS AND CO., WRITTEN REMARKS AT THE EPA/CONSERVATION FOUNDATION CONFERENCE ON CFC ALTERNATIVES 5 (Jan. 14, 1988) (copy on file at *Washington Law Review*). Because substitutes may have acute human health or environmental effects, complete toxicity testing should be required. Due to the urgency of rapid substitute commercialization, government could cooperate with industry to expedite complete testing.

Some substitutes being tested, including HCFC compounds, will add pollution to the atmosphere: they may increase ozone formation in the lower atmosphere, contributing to urban smog. The EPA could impose regulations on HCFC compounds, allowing their use only as an intermediate step in weaning industry from CFCs. Regulations could encourage producers to continue their search for environmentally sound substitutes.

90. EPA, REGULATORY IMPACT ANALYSIS, *supra* note 8, at 4-19.

91. Windfall profits could range from $2 billion to $6 billion over the coming decade. D. DONIGER, *supra* note 67, at 17. On the other hand, windfall profits may not materialize. Per-unit profits will be up due to regulated supply, but the number of CFC units sold may decline.

92. *See supra* note 16 and accompanying text.

CFCs.[93] The EPA could condition these imports on the development in other countries of phasedown programs similar to those in the United States. The EPA, then, is in a position to extract additional reductions from other countries and to protect domestic industry from imports that do not comply with the terms of the Protocol.[94]

Industry representatives, however, argue against such unilateral action by the United States.[95] The language of Section 157(b) requires the EPA to "take into account the feasibility and the costs of achieving" regulations.[96] Industry argues that the EPA has failed to respond adequately to the costs of achieving control.[97] Although producers of CFCs could gain from profits on regulated supplies and from the benefits of a new market in CFC alternatives, user industries will suffer retrofitting costs where substitutes require adaptations of existing products and manufacturing processes.[98]

Industry is also concerned that unilateral reductions by the United States will result only in loss of market share to foreign competitors,

93. The EPA has broad authority under Section 157 of the Clean Air Act. *See supra* notes 80–84 and accompanying text. The statute can be construed to cover the practice or activity of importing CFC-containing or CFC-derived goods into the United States. The United States Trade Representative has ruled that such a measure would comply with the GATT and other international trade laws if, as here, it has a sound health and environmental justification. *See supra* note 51; *see also* D. DONIGER, *supra* note 67, at 16.

94. D. DONIGER, *supra* note 67, at 32.

95. A Du Pont policy statement pledging a total phaseout of CFC production advocates international cooperation rather than unilateral action by the United States. *Scientific Findings Suggest Total Phaseout, supra* note 88, at 11. Du Pont foresees phasing out production by "shortly after the turn of the century"—contingent on successful results of toxicity tests. Telephone interview with Kathleen H. Forte, Senior Public Affairs Specialist of E.I. Du Pont De Nemours and Co. (May 10, 1988) (notes on file at *Washington Law Review*). Unfortunately, given confirmed depletion levels, the Du Pont phaseout is not fast enough, and may serve only to diminish the political momentum behind calls for stepped-up control provisions.

96. Clean Air Act § 157(b), 42 U.S.C. § 7457(b) (1982).

97. The Alliance for Responsible CFC Policy, a coalition representing the five domestic manufacturers of CFCs and several hundred users of CFCs, supports ratification of the Montreal Protocol and EPA implementation of the accord, but estimates social costs to the United States of approximately $5.5 billion between the years 1990 and 2010. ENVIRONMENTAL PROTECTION AGENCY, TRANSCRIPT OF PROCEEDINGS: PUBLIC HEARING ON STRATOSPHERIC PROTECTION, No. A-87-20, at 12 (Jan. 7–8, 1988) [hereinafter EPA, TRANSCRIPT OF PROCEEDINGS] (statement of Kevin Fay, CFC Alliance). Costs will include those for research and plant construction, lost jobs, and business failures. Hays, *CFC Curb to Save Ozone Will Be Costly*, Wall St. J., Mar. 28, 1988, at 6, col. 1.

98. Congress could implement subsidies and tax breaks for retrofitting costs incurred by user industries. Also, to the extent windfall profits do not materialize for producers, tax breaks could aid substitutes research and development. A commitment of government resources would expedite substitutes and the transition to CFC-free products. *See infra* notes 111, 117–18 and accompanying text.

and not in international reduction of CFC production.[99] Industry argues that the ozone problem is worldwide, and thus the solution must be global in scope. The Earth can only be fully protected from the harmful effects of increased UV-B radiation and greenhouse warming through an international agreement.[100]

The urgency of the situation demands that the United States use its influence to end CFC use. The United States could strongly encourage its allies and the Soviet Union to ratify the Montreal Protocol quickly, followed by immediate reassessment and strengthening of the Protocol provisions.[101] The United States could also lead negotiations for more stringent control provisions on a widely acceptable basis. However, should the international community fail to address the urgency of the ozone depletion threat—failing either to ratify promptly or to renegotiate immediately more stringent control provisions—then the EPA unilaterally could impose the following domestic provisions.

B. A Four-Part Proposal for Domestic Provisions That Would Adequately Address the Ozone Depletion Threat

To comply with the Montreal Protocol, as well as to take the lead in strengthening the Protocol's protection of the ozone layer, the EPA could issue rules under its Clean Air Act authority.[102] These rules could pursue the following objectives.[103] First, they could respond to recent scientific discoveries by stepping up the schedule for phasing out CFC and halon production. Second, the rules could require regulatory negotiations with user industries to encourage CFC recycling and conservation. Third, the rules could impose a fee on producers' windfall profits (should they materialize), earmarked for research on

99. Trade measures could help remedy market share problems. *See supra* note 93 and accompanying test.

100. EPA, TRANSCRIPT OF PROCEEDINGS, *supra* note 97, at 64 (statement of Mack McFarland, atmospheric scientist, member of the Fluorocarbon Program Panel, Chemical Manufacturers Association).

101. *NRDC Calls for Speedier Phase-Out, 'Windfall Profits' Fees on Production*, 12 Chem. Reg. Rep. (BNA) 12 (Apr. 1, 1988) [hereinafter *NRDC Calls for Speedier Phase-Out*] (quoting David D. Doniger, NRDC.)

102. The EPA's Proposed Rule, *supra* note 6, could be modified to incorporate this four-point proposal.

103. EPA, TRANSCRIPT OF PROCEEDINGS, *supra* note 97, at 195 (statement of Liz Cook, Friends of the Earth—U.S.A.).

Both Senator Baucus and Senator Chafee introduced bills on February 19, 1987 calling for similar provisions, including a 95% cut in CFC production. S. 570, S. 571, 100th Cong., 1st Sess., 133 CONG. REC. S2283–92 (Feb. 19, 1987). Both bills offer the EPA valuable suggestions for regulating ozone depletion.

CFC substitutes. Fourth, such rules could require product labeling to promote a reduction in CFC demand and to encourage substitutes.

1. A Seven-Year Phasedown in Response to Recently Confirmed Ozone Depletion

Regulations of ozone-depleting chemicals could be stronger to reflect recent data on the thinning of the global ozone layer.[104] The proposed ten-year, fifty percent reduction of CFC and halon production is insufficient; a rapid phaseout of these chemicals is necessary.[105] Furthermore, a stepped-up timetable for phasing out CFCs and halons is feasible. Feasibility is facilitated by producers who are already cooperating in the search for viable substitutes, and toxicity research shows substitutes are within reach.[106] Producers of CFCs anticipate commercialization of substitutes within seven years.[107] To address the gravity of the problem, industry could follow a rapid phaseout schedule coupled with incentives for the immediate commercialization of substitutes. Both the EPA rule and the Montreal Protocol require revision to meet the urgency and the commercial feasibility of a CFC and halons phaseout.

The following timetable for CFC reductions could serve as a guideline. Beginning January 1, 1989, the EPA could cut production of CFCs and halons twenty percent from 1986 baseline levels. Effective January 1, 1992, the EPA could cut production an additional thirty percent below 1986 baseline levels. On January 1, 1995, the EPA could cut production quotas an additional thirty-five percent, leaving only fifteen percent of 1986 baseline production levels in production. The EPA could then issue permits for essential uses only.[108] On January 1, 1996, the EPA could phase down production of CFCs and halons to five percent of 1986 baseline levels.

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104. *See supra* notes 4–5 and accompanying text.

105. D. DONIGER, NATURAL RESOURCES DEFENSE COUNCIL, WRITTEN STATEMENT AT THE CONSERVATION FOUNDATION/EPA CONFERENCE ON SUBSTITUTES AND ALTERNATIVES TO CFCS AND HALONS 3 (Jan. 14, 1988) (copy on file at *Washington Law Review*).

106. *See supra* notes 88–89 and accompanying text.

107. *See supra* note 89 and accompanying text.

108. Essential use permits could be issued under similar criteria to the aerosol ban "essentiality" determinations, including nonavailability of alternative products, economic significance of the product (including the economic effects of removing the product from the market), environmental and health significance of the product, effects on the 'quality of life' resulting from no longer having the product available or from using an alternative product. Environmental Protection Agency, Fully Halogenated Chlorofluoroalkanes; Denial of Exemption for Use of Chlorofluorocarbons in Aerosol Self-Defense Chemical Weapons Processed for Export, 47 Fed. Reg. 51,866 (1982); *see* 3 W. RODGERS, ENVIRONMENTAL LAW: PESTICIDES AND TOXIC SUBSTANCES § 6.7 (1988).

Diplomatic efforts to encourage trade partners to adopt similar reduction schedules could parallel this phasedown schedule.[109] To discourage new production overseas, OPIC and other national assistance programs could implement development assistance programs to subsidize the transfer of substitute chemicals and alternative technologies to LDCs.[110]

2. *Regulatory Negotiations and Tax Incentives To Encourage User Industry Retrofitting and Conservation*

Immediately following the initial proposed twenty percent production cut, the EPA could commence regulatory negotiations with affected industries. Negotiations could develop voluntary programs for substitution, conservation, and reclamation of CFCs.[111] Retrofitting costs for user industries may require government subsidies and tax breaks. A commitment of government resources could expedite the transition to CFC-free products.

Voluntary measures could result in sizeable reductions in CFC use in the near future. Negotiations with each industry over opportunities for conservation and recycling, including engineering modifications and improved containment, could eliminate unnecessary CFC emissions during the development of substitutes.[112] As alternatives become practicable, the EPA could, through negotiation, encourage industries to use them.[113] If user industries do not voluntarily implement phaseout measures when substitutes are available, the EPA could immediately impose a penalty fee or a ban on non-essential CFC and halon uses.

3. *Earmark Windfall Profits for Substitute Research*

Initial regulatory negotiations, besides encouraging the switch to alternatives among user industries, could also encourage the development of substitutes among the five domestic CFC and halon produ-

109. *See supra* note 101 and accompanying text.

110. *See supra* notesl 67–69 and accompanying text.

111. EPA, TRANSCRIPT OF PROCEEDINGS, *supra* note 97, at 45 (statement of Robert Traflet, Allied-Signal, Inc.). Millions of pounds of CFCs currently circulate in refrigerator and air conditioner coils, and in numerous other products. The EPA could design a national program that requires the reclamation, recycling, or destruction of CFCs. New legislation may be needed to encourage the development of destruction technologies through research and development subsidies and tax incentives. Technology that safely destroys CFCs and halons should be mandatory when it becomes available. *Id.* at 192 (statement of Liz Cook, Friends of the Earth—U.S.A.).

112. *Id.* at 45–46 (statement of Robert Traflet, Allied-Signal, Inc.).

113. *Id.* at 190–91 (statement of Liz Cook, Friends of the Earth—U.S.A.).

cers.[114] Regulatory negotiations could include constant monitoring and assessment of producers' sales and prices. If windfall profits materialize for a producer,[115] the EPA could negotiate with the producer so that the windfall is channeled into that company's research and development of substitutes. The EPA could also assess a compulsory fee on producers who fail to channel windfall profits to the research and development of alternatives or who hesitate to introduce substitutes.[116] The compulsory fee system could divert windfall profits to a United States Treasury fund[117] dedicated to financing the subsidies and tax incentives given user industries for retrofitting costs.[118]

4. Labeling

To ensure continued voluntary industry cooperation, the EPA could also require labeling of products that contain CFCs and halons.[119] Such labels could, for example, state the following:

> *Warning: Contains (name of controlled substance), a substance which destroys ozone in the upper atmosphere and disrupts climate, endangering public health and the environment.*[120]

The public has a right to know which products contribute to ozone depletion. Public awareness and pressure are essential factors in

114. The EPA could press both producers and users of CFCs and halons during regulatory negotiations to voluntarily phase out their production or use of ozone-depleting chemicals. Voluntary pledges could include specific deadlines for action. *NRDC Calls for Speedier Phase-Out, supra* note 101, at 12 (quoting David D. Doniger, NRDC).

115. *See supra* note 91 and accompanying text.

116. The EPA could impose these fees on the sale of CFCs or halons on a per-pound basis. D. DONIGER, *supra* note 67, at 18. Senator Bumpers advocates a high fee of five to ten times the current price of 50 cents to $1.00 per pound in order to encourage alternatives, conservation and recycling of CFCs. *NRDC Calls for Speedier Phase-Out, supra* note 101, at 12.

117. EPA, TRANSCRIPT OF PROCEEDINGS, *supra* note 97, at 193 (statement of Liz Cook, Friends of the Earth—U.S.A.).

The EPA has authority to impose compulsory fees on producers under Section 157(b) of the Clean Air Act. *See supra* notes 83–84, 93 and accompanying text. The Supreme Court upheld the use of both fees and quotas to accomplish an objective similar to that proposed to regulate CFCs and halons: restraining oil imports through fees on import quotas. Federal Energy Administration v. Algonquin SNG, Inc., 426 U.S. 548 (1976). The case provides authority for an EPA-instituted compulsory fee system. D. DONIGER, *supra* note 67, at 19–22.

118. The EPA could also use these fees for subsidizing tax breaks to producers for research and development of substitutes where windfall profits fail to materialize. *See supra* note 98.

119. A labeling requirement is within the EPA's authority under Section 157(b) of the Clean Air Act, which allows "control of any substance, *practice*, process, or *activity* . . . ." (emphasis added) 42 U.S.C. § 7457(b) (1982); *see supra* notes 83–84 and accompanying text.

120. D. DONIGER, D. WIRTH, & N. DEAN, COMMENTS OF NATURAL RESOURCES DEFENSE COUNCIL AND NATIONAL WILDLIFE FEDERATION ON THE ENVIRONMENTAL PROTECTION AGENCY'S PROPOSED REGULATIONS LIMITING PRODUCTION AND CONSUMPTION OF CHLOROFLUOROCARBONS AND HALONS 12–13 (Feb. 8, 1988) (copy on file at *Washington Law Review*). A similar label could apply to products "*manufactured with*" CFCs or halons. *Id.*

achieving swift reductions of CFC and halon consumption.[121] Furthermore, because corporate responsibility and public image influence sales, mandatory labeling provides another incentive for manufacturers to phase out their use of chemicals that destroy the ozone layer.[122]

IV. CONCLUSION

Chlorofluorocarbons are destroying Earth's ozone layer. Newly discovered scientific data indicates that human health and the environment are at risk. Global political and legal institutions must encourage, through regulation and market incentives, a dramatic intensification of efforts to secure safe substitutes for CFCs and halons.

The Montreal Protocol is an important milestone in international cooperation. It is a critical first step in protecting human health and the environment from increasing levels of ultraviolet radiation and greenhouse warming. The Protocol is not, however, the last step. The United Nations Environment Programme negotiated the Protocol prior to definitive results showing widespread stratospheric ozone depletion. Rather than the Protocol's fifty percent cut over ten years, a more rapid phasedown in chlorofluorocarbon and halon production is imperative.

The Environmental Protection Agency's implementation of the Montreal Protocol also does too little too late. The United States should take the lead in encouraging trade partners to ratify the Montreal Protocol, and should call for an immediate renegotiation of the Protocol's schedule of control provisions. Should international measures fail to mandate stronger provisions, the EPA should take unilateral action to implement a more rapid domestic production phasedown. The United States should then pressure other nations, through trade sanctions on CFC-containing goods, to implement comparable phasedown regulations.

A $28 billion industry depends on chemical compounds that directly threaten human health and the biosphere. It is imperative to shift away from these compounds, and to replace them with economically and environmentally viable alternatives. The task is feasible with

121. Labeling information in the late 1970's led to a strong consumer choice to avoid CFC aerosol products. *Id.* at 11.

122. To the extent that labeling is effective in encouraging rapid reductions in CFC and halon consumption and a rapid shift toward commercialization of substitutes, the EPA may have less need to impose the stringent compulsory fee system described above at notes 116–18.

strong commitment and cooperation among producer and user industries, government officials, and the public.

Douglas Hunter Ogden