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HFC SMUGGLING: PREVENTING THE ILLICIT (AND LUCRATIVE) SALE OF GREENHOUSE GASES

GRAHAM DONNELLY WELCH*

Abstract: The Kigali Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer is a pivotal development in global cooperation to stem climate change. Through incorporating hydrofluorocarbons into the Montreal Protocol, the international community will be able to combat the deleterious effects of a common, yet potent, chemical. Nonetheless, the United States and its fellow parties will likely have to combat an illicit trade in these banned substances in the immediate future. Through lessons learned from the original Montreal Protocol, the United States can effectively combat smuggling and ensure the Kigali Amendment's success.

INTRODUCTION

As Environmental Protection Agency (EPA) Administrator Lee Thomas explained, “we may need to act in the near term to avoid letting today’s ‘risk’ become tomorrow’s ‘crisis.’”¹ This statement typified the mindset of preemptive action that led to the watershed agreement of the Montreal Protocol on Substances that Deplete the Ozone Layer (“Montreal Protocol”).² The Montreal Protocol successfully achieved near universal agreement to remove chlorofluorocarbons (“CFCs”).³ In the wake of the Montreal Protocol’s regulation of CFCs a vast international black market emerged for these

* Managing Editor, BOSTON COLLEGE ENVIRONMENTAL AFFAIRS LAW REVIEW, 2016–2017.

¹ KAREN T. LITFIN, OZONE DISCOURSES: SCIENCE AND POLITICS IN GLOBAL ENVIRONMENTAL COOPERATION 103 (1994) (citing Paul Brodeur, *Annals of Chemistry: In the Face of Doubt*, NEW YORKER, June 1986, at 73, 86).

² See Montreal Protocol on Substances that Deplete the Ozone Layer, Preamble, Sept. 16, 1987, S. TREATY DOC. NO. 100-10 (1987), 1522 U.N.T.S. 3 [hereinafter Montreal Protocol]; LITFIN, *supra* note 1, at 103; Cass R. Sunstein, *Of Montreal and Kyoto: A Tale of Two Protocols*, 31 HARV. ENVTL. L. REV. 1, 3 (2007).

³ Elizabeth R. DeSombre, *The Experience of the Montreal Protocol: Particularly Remarkable, and Remarkably Predictable*, 19 UCLA J. ENVTL. L. & POL’Y 49, 49 (2001); Justin Gillis, *The Montreal Protocol: A Little Treaty That Could*, N.Y. TIMES, Dec. 9, 2013, at D3; see *infra* notes 27–49 and accompanying text (providing an overview of chlorofluorocarbons (“CFCs”) and their impact on the ozone layer).

chemicals.⁴ The treaty's massive reduction of legal CFCs, led to increased demand for an illegal replacement.⁵ In the words of one assistant United States Attorney, importers of illegal CFCs received "a better return on their investment than cocaine" through smuggled chemicals.⁶

After instituting official restrictions on the production, consumption, and transport of ozone depleting chemicals, governments struggled to prepare for the subsequent threat of CFC smuggling.⁷ Enterprising criminals capitalized on inefficiencies in federal and international enforcement mechanisms and imported the chemicals to buyers within the United States.⁸ Developed nations, such as the United States, failed to fully stem the production of CFCs by providing inadequate support to developing nations in their efforts to combat CFC production, and insufficiently punishing defection from the international agreement.⁹ Although the United States largely succeeded in finally combating this black market, the delay came at the cost of continued depletion to the Earth's ozone layer.¹⁰

The danger of an analogous substance, hydrofluorocarbons ("HFCs"), in the atmosphere poses a significant threat to the earth by exacerbating global warming and requires a forceful response.¹¹ On October 15, 2016, in Kigali, Rwanda, the signatory nations of the Montreal Protocol finalized an amendment to the agreement structuring a phase-out of HFCs, making a significant step toward reducing greenhouse gas emissions ("Kigali Amendment").¹² With the agreement to reduce HFCs comes the threat of smuggling

⁴ *United States v. LeBlanc*, 169 F.3d 94, 98 (1st Cir. 1999); Timothy T. Jones, *Implementation of the Montreal Protocol: Barriers, Constraints and Opportunities*, 3 ENVTL. LAW. 813, 830 (1997).

⁵ Alex Nussbaum, *World's Worst Greenhouse Gas Spurs Global Smuggling Rings*, BLOOMBERG (Oct. 29, 2015), <https://www.bloomberg.com/news/articles/2015-10-30/world-s-worst-greenhouse-gas-spurs-global-smuggling-rings> [<https://perma.cc/T6V6-KSBE>].

⁶ *Id.*

⁷ See *infra* notes 90–125 and accompanying text (outlining the rise of CFC smuggling operations and subsequent government efforts to combat this illicit trade, including the challenges law enforcement faced).

⁸ Saleem S. Saab, *Move Over Drugs, There's Something Cooler on the Black Market—Freon: Can the New Licensing System Stop Illegal CFC Trafficking?*, 16 DICK. J. INT'L L. 633, 652–53 (1998).

⁹ Nina E. Bafundo, Comment, *Compliance with the Ozone Treaty: Weak States and the Principle of Common but Differentiated Responsibility*, 21 AM. U. INT'L L. REV. 461, 493–94 (2006).

¹⁰ Frederick Poole Landers, Jr., Note, *The Black Market Trade in Chlorofluorocarbons: The Montreal Protocol Makes Banned Refrigerants a Hot Commodity*, 26 GA. J. INT'L & COMP. L. 457, 478 (1997).

¹¹ See DeSombre, *supra* note 3, at 64.

¹² U.N. Env't Programme, *Report of the Twenty-Eighth Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer*, U.N. Doc. UNEP/OzL.Pro.28/12, Annex I (Nov. 15, 2016) [hereinafter Kigali Amendment]; Coral Davenport, *Nations, Fighting Powerful Refrigerant That Warms Planet, Reach Landmark Deal*, N.Y. TIMES (Oct. 15, 2016), <https://www.nytimes.com/2016/10/15/world/africa/kigali-deal-hfc-air-conditioners.html> [<https://perma.cc/4PGF->

of these chemicals.¹³ The United States and other members of the international community will have a chance to heed the lessons of CFC reduction as they work to diminish another environmentally dangerous chemical, HFCs.¹⁴

In Part I, this Note will provide an overview of the threat of ozone depletion, specifically from CFCs and other ozone depleting substances (“ODSs”).¹⁵ Next, it will detail the multilateral efforts to combat ozone depletion, which ultimately resulted in the landmark enactment of the Montreal Protocol.¹⁶ This Note will describe how the United States incorporated the Montreal Protocol’s terms into domestic law.¹⁷ This Note will then explain how, despite this international and domestic legal structure, illegal smuggling of CFCs threatened the success of the Montreal Protocol.¹⁸ This Note will then explain the new environmentally-detrimental chemical added into the Montreal Protocol’s schema: HFCs.¹⁹ Finally, Part I concludes with a discussion of how the Kigali Amendment addresses HFC reduction across the globe.²⁰

Part II of this Note will argue that, as the United States and other nations prepare to curb the dangerous effects of HFCs through the Kigali Amendment, policy makers should adopt a proactive strategy to prevent the illicit trade of environmentally dangerous chemicals.²¹ While the Kigali Amendment did fail to address all of the risks of possible HFC smuggling, particularly through extended grace periods for developing states, this Note will explain that it does not preclude effective enforcement of anti-smuggling ef-

U9TF]; Aaron Messing, *The New Kigali Amendment to the Montreal Protocol Takes Positive Steps to Curb Potent Greenhouse Emitter*, GEO. ENVTL. L. REV. (Oct. 30, 2016), <https://gelr.org/2016/10/30/the-new-kigali-amendment-to-the-montreal-protocol-takes-positive-steps-to-curb-potent-greenhouse-emitter/> [https://perma.cc/74CG-ENEAE] (published online as part of the journal’s digital supplement). See generally U.N. Env’t Programme, *Report of the Twenty-Seventh Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer*, U.N. Doc. UNEP/OzL.Pro.27/13 (Nov. 30, 2015) [hereinafter *Report of the Twenty-Seventh Meeting of the Parties to the Montreal Protocol*] (presenting the results of the 2015 Dubai meeting of Montreal Protocol Parties as they prepared for the Kigali Amendment).

¹³ See ENVTL. INVESTIGATION AGENCY, *WHEELS IN MOTION: TOWARDS AN INTERNATIONAL PHASE-DOWN OF HFCs 12–14* (Oct. 22, 2013), <https://eia-global.org/reports/wheels-in-motion-towards-an-international-phase-down-of-hfcs> [https://perma.cc/G8BX-KKTK] [hereinafter *WHEELS IN MOTION*] (a PDF of the report is available as a navigable document embedded in the webpage).

¹⁴ Veronica Kennedy, *The Montreal Protocol: Fit for Hydrofluorocarbons*, 12 SUSTAINABLE DEV. L. & POL’Y, Winter 2012, at 25, 25; see *infra* notes 110–125 and accompanying text.

¹⁵ See *infra* notes 27–49 and accompanying text.

¹⁶ See *infra* notes 50–74 and accompanying text.

¹⁷ See *infra* notes 75–89 and accompanying text.

¹⁸ See *infra* notes 90–124 and accompanying text.

¹⁹ See *infra* notes 126–144 and accompanying text.

²⁰ See *infra* notes 145–169 and accompanying text.

²¹ See Kennedy, *supra* note 14, at 25; *infra* notes 170–184 and accompanying text..

forts.²² This Note will then explain how the destruction of HFC “banks” can serve as a proactive measure against smuggling.²³ Next, this Note will look to domestic law and international agreements, specifically the Resource Conservation and Recovery Act (“RCRA”) and the Convention on International Trade in Endangered Species of Wild Flora and Fauna (“CITES”) for lessons on enforcement of environmental prohibitions.²⁴ Finally, this Note will explain the consequences of inaction if the United States and the international community fail to adequately combat HFC smuggling.²⁵ Ultimately, this Note concludes that the parties of the Montreal Protocol have made a significant accomplishment towards combating climate change through the Kigali Amendment, and the prevention of HFC smuggling will be a major step in the execution of the agreement.²⁶

I. MULTILATERAL EFFORTS TO COMBAT OZONE DEPLETION AND THE RISE OF ILLICIT CHEMICAL SMUGGLING

A. *The Importance of Ozone and the Environmental Threat of Ozone Depleting Substances*

1. Ozone and the Effects of Ultraviolet Radiation

The ozone layer is a thin band of accumulated ozone, a compound made of three oxygen molecules, located in the stratosphere layer of the Earth’s atmosphere.²⁷ Within the stratosphere, ozone plays an essential role in the health of terrestrial ecosystems.²⁸ These ozone molecules absorb ultraviolet (“UV”) radiation emitted by the sun.²⁹ Although the UV rays dissolve the ozone compounds, the oxygen molecules largely reform into new ozone that can absorb further radiation.³⁰ The process is largely stable, except when the ozone is broken apart by unnatural chemical compounds, such as chlorofluorocarbons (“CFCs”).³¹

²² See *infra* notes 185–204 and accompanying text.

²³ See *infra* notes 217–226 and accompanying text.

²⁴ See *infra* notes 227–232 and accompanying text.

²⁵ See *infra* notes 233–244 and accompanying text.

²⁶ See *infra* notes 170–176 and accompanying text.

²⁷ 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, 270 (1992).

²⁸ Orval E. Nangle, *Stratospheric Ozone: United States Regulation of Chlorofluorocarbons*, 16 B.C. ENVTL. AFF. L. REV. 531, 535 (1989).

²⁹ *Id.*

³⁰ *Id.* at 537.

³¹ Glenn B. Raiczuk, *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, 366 (1992).

Ozone's UV-absorbing function is vitally important to both the preservation of aquatic and terrestrial ecosystems and to public health.³² Without a functioning ozone layer, the sun's UV rays can penetrate the Earth's atmosphere.³³ UV exposure is particularly dangerous for humans, as it has been directly linked with non-melanoma skin cancers, decreased immune system function, and eye damage.³⁴

In addition to the deleterious impacts on human health, UV radiation can have a strong adverse impact on the global environment.³⁵ For instance, UV radiation can affect the productivity of agricultural products and other plant-based life, and it can also cause adverse health effects for terrestrial animals.³⁶ Furthermore, UV rays can penetrate more than ten meters into clear bodies of water, reducing the regenerative abilities and growth of phytoplankton, which are crucial to many ecosystems.³⁷ Fortunately for humans and all members of the terrestrial ecosystem, a functioning ozone layer provides protection from these dangers.³⁸

2. Development and Proliferation of CFCs

CFCs do not occur naturally in the Earth's atmosphere; rather, they are synthetic chemicals that were once prominent and lucrative components of

³² Gallagher, *supra* note 27, at 273. Terrestrial ecosystems consist of the interactions of flora and fauna that occur in an area on land, in contrast with aquatic ecosystems. See Michael T. Pyle, Note, *Beyond Fish Ladders: Dam Removal as a Strategy for Restoring America's Rivers*, 14 STAN. ENVTL. L.J. 97, 112–14 (1995).

³³ Gallagher, *supra* note 27, at 273.

³⁴ ARJUN MAKHIANI & KEVIN R. GURNEY, MENDING THE OZONE HOLE: SCIENCE, TECHNOLOGY, AND POLICY 73–75 (1995); Nancy D. Adams, *Title VI of the 1990 Clean Air Act Amendments and State and Local Initiatives to Reverse the Stratospheric Ozone Crisis: An Analysis of Preemption*, 19 B.C. ENVTL. AFF. L. REV. 173, 175–76 (1991); Sumudu Atapattu, *The Public Health Impact of Global Environmental Problems and the Role of International Law*, 30 AM. J.L. & MED. 283, 289 (2004); Nangle, *supra* note 28, at 537–38.

³⁵ Gallagher, *supra* note 27, at 273.

³⁶ Adams, *supra* 34, at 176.

³⁷ DONAT-P. HÄDER, THE EFFECTS OF OZONE DEPLETION ON AQUATIC SYSTEMS 12, 15 (1st ed. 1997). Phytoplankton, a microscopic form of oceanic plant life, plays a valuable role in the preservation of ocean ecosystems. Robin Kundis Craig, *Ocean Governance for the 21st Century: Making Marine Zoning Climate Change Adaptable*, 36 HARV. ENVTL. L. REV. 305, 323 (2012). Not only do these microscopic plants serve as core components of aquatic ecosystems as a food source for other life forms, but phytoplankton also have the environmental benefit of absorbing the greenhouse gas carbon dioxide during photosynthesis, thereby removing it from the atmosphere. Daniel P. Larsen, *Combating the Exotic Species Invasion: The Role of Tort Liability*, 5 DUKE ENVTL. L. & POL'Y F. 21, 24 (1995); Grant Wilson, *Murky Waters: Ambiguous International Law for Ocean Fertilization and Other Geoengineering*, 49 TEX. INT'L L.J. 507, 516 (2014).

³⁸ See ANNIKA NILSSON, ULTRAVIOLET REFLECTIONS: LIFE UNDER A THINNING OZONE LAYER 15–16 (1996).

industrial equipment.³⁹ Frequently known by their brand name, Freon, CFCs are halocarbon compounds that combine with other halogen gases and vaporize at low temperatures.⁴⁰ When they were first invented in the 1930s, CFCs were a replacement for other refrigerant chemicals such as ether vapor, ammonia, and sulfur dioxide, all of which were much more unstable and dangerous to humans.⁴¹ By the 1980s, CFCs were used in the United States for a variety of purposes, but primarily as coolants in domestic and automobile air conditioners, propellants in aerosol spray cans and fire extinguishers, and computer hardware.⁴² As the possible applications for CFCs proliferated, so too did their demand—by the late 1980s, worldwide consumption of the chemicals totaled approximately 1.1 million metric tons.⁴³

3. The Rowland-Molina Hypothesis and the Adverse Atmospheric Impact of CFCs

Despite their industrial and consumer benefits, CFCs also had major unintended environmental consequences.⁴⁴ CFCs significantly threatened the protection provided by the ozone layer.⁴⁵ The link between ozone depletion and CFCs first became known in 1974, when atmospheric researchers Sherwood Rowland and Marion Molina published their theory about the impact of CFCs on the ozone layer.⁴⁶ Specifically, Rowland and Molina hypothesized that CFCs and other ozone depleting substances (“ODSs”) remained in the atmosphere for extended periods of time, ultimately react-

³⁹ Pamela Wexler, *Protecting the Global Atmosphere: Beyond the Montreal Protocol*, 14 MD. J. INT’L L. & TRADE 1, 3 (1990); Douglas Hunter Ogden, Comment, *The Montreal Protocol: Confronting the Threat to Earth’s Ozone Layer*, 63 WASH. L. REV. 997, 999 (1988).

⁴⁰ Adams, *supra* note 34, at 177; Jones, *supra* note 4, at 830 n.20.

⁴¹ Raiczuk, *supra* note 31, at 365.

⁴² *Id.* at 366.

⁴³ Landers, *supra* note 10, at 460. CFC production peaked in 1974, following an annual increase in production of approximately thirteen percent per year from 1960 to 1974. Joanne Kauffman, *Domestic and International Linkages in Global Environmental Politics: A Case-Study of the Montreal Protocol*, in *THE INTERNALIZATION OF ENVIRONMENTAL PROTECTION* 74, 76 (Miranda A. Scheurs & Elizabeth Economy, eds., 1997)

⁴⁴ See Raiczuk, *supra* note 31, at 366.

⁴⁵ *Id.*

⁴⁶ Mario J. Molina & F. S. Rowland, *Stratospheric Sink for Chlorofluoromethanes: Chlorine Atom-Catalysed Destruction of Ozone*, 249 NATURE 810, 810 (1974); Laura Thoms, *A Comparative Analysis of International Regimes on Ozone and Climate Change with Implications for Regime Design*, 41 COLUM. J. TRANSNAT’L L. 795, 799 (2003). Molina and Rowland were ultimately awarded the 1995 Nobel Prize in Chemistry for their research related to the ozone layer. Jonathan Baert Wiener, *Global Environmental Regulation: Instrument Choice in Legal Context*, 108 YALE L.J. 677, 686 n.30. (1999).

ing with ozone molecules to break down the ozone.⁴⁷ The disintegration of CFCs in the upper atmosphere released large quantities of chlorine atoms, which could destroy large quantities of ozone molecules.⁴⁸ Rowland and Molina's report made global leaders more aware of the threat of sustained ozone depletion, but remained uncertain as to any definitive link between ozone depletion and chemical usage.⁴⁹

B. Initial International Recognition of the Threat of Ozone Depletion and the Vienna Convention

The international community first collectively addressed ozone depletion and its impact on humans in 1985, when forty-three countries signed the Vienna Convention for the Protection of the Ozone Layer ("Vienna Convention").⁵⁰ At the convention, signatory nations worked under an understanding that ozone depletion was a significant environmental and public health problem, ultimately establishing a framework for information sharing, increased monitoring, and setting the stage for further talks on halting ozone depletion.⁵¹ Nevertheless, the Vienna Convention did not establish any concrete regulations on CFC usage, as delegate nations remained uncertain of the science linking CFCs and ozone depletion.⁵² Despite the delegates' uncertainty as to the specific effects of CFC use in disintegrating the ozone layer, the Vienna Convention provided a mechanism to measure its effects, with the ultimate goal to combat the problem of CFC-related ozone depletion with full information.⁵³

As the effects of CFC exposure on the ozone layer and the effects of ozone depletion became more accepted, the international community began

⁴⁷ Bing Ling, *Developing Countries and Ozone Layer Protection: Issues, Principles, and Implications*, 6 TUL. ENVTL. L.J. 91, 93 (1992).

⁴⁸ ANDREW DESSLER, *THE CHEMISTRY AND PHYSICS OF STRATOSPHERIC OZONE* 61–62 (2000).

⁴⁹ David Hurlbut, *Beyond the Montreal Protocol: Impact on Nonparty States and Lessons for Future Environmental Protection Regimes*, 4 COLO. J. INT'L ENVTL. L. & POL'Y 344, 346 (1993).

⁵⁰ Ling, *supra* note 47, at 94. Ultimately, twenty countries and the European Community signed the Vienna Convention. *Id.*

⁵¹ Brett Frischmann, *A Dynamic Institutional Theory of International Law*, 51 BUFF. L. REV. 679, 791–92 (2003).

⁵² *Id.* This reluctance to accept a definitive link between CFCs and ozone depletion was evident in the text of the Vienna Convention itself, which never explicitly linked any particular substance to ozone depletion. RICHARD ELLIOT BENEDICK, *OZONE DIPLOMACY: NEW DIRECTIONS IN SAFEGUARDING THE PLANET* 45 (2d ed. 1998).

⁵³ Vienna Convention for the Protection of the Ozone Layer, art. 2, sec. 1, Mar. 22, 1985, S. TREATY DOC. 99-9, 1513 U.N.T.S. 293; Frischmann, *supra* note 51, at 792; see Anthony E. Chavez, *A Napoleonic Approach to Climate Change: The Geoengineering Branch*, 5 WASH. & LEE J. ENERGY, CLIMATE, & ENV'T 93, 145–46 (2013) (describing the Vienna Convention and Montreal Protocol's focus on regulating materials harmful to the ozone layer).

both individual and cooperative efforts to curb the problem.⁵⁴ In 1977, the United States largely restricted the use of CFCs in aerosol spray cans following a report linking CFCs to ozone depletion.⁵⁵ By 1982, Canada and the European Community instituted their own restrictions of CFCs in aerosols.⁵⁶ Despite these individual efforts, ozone depletion remained a global issue with a global cause, and the international community sought a multilateral solution.⁵⁷

The Vienna Convention set the stage for further multilateral agreements to combat ozone depletion, requesting the Executive Director of the United Nations Environmental Programme (“UNEP”) to begin work on a new protocol based on incoming data.⁵⁸ In the interim period between Vienna and a new convention, the data continued to demonstrate a link between CFCs and ozone depletion.⁵⁹ In 1985, researchers in Antarctica found that CFCs and other chemicals created a substantial gap in the ozone layer, leaving the Antarctica without any protection from UV rays.⁶⁰ In addition, the UNEP’s completed series of reports, published in 1986, concluded that the concentration of certain CFCs in the stratosphere doubled in the period between 1975 and 1985—the reports also predicted a nine percent decrease in the ozone layer by the year 2000.⁶¹ As international momentum to ban ODSs grew, so too did the scientific consensus that the regulations should begin with CFCs.⁶²

C. The Montreal Protocol

On September 16, 1987, twenty-four countries signed the Montreal Protocol, a watershed moment in ozone regeneration and international environmental law.⁶³ The final treaty adopted a “command and control” frame-

⁵⁴ Jennifer S. Bales, *Transnational Responsibility and Recourse for Ozone Depletion*, 19 B.C. INT’L & COMP. L. REV. 259, 267–68 (1996).

⁵⁵ 21 C.F.R. § 2.125 (2016); Elias Mossos, *The Montreal Protocol and the Difficulty with International Change*, 10 ALB. L. ENVTL. OUTLOOK J. 1, 7 n.22 (2005).

⁵⁶ Matthew I. Kupferberg, *Fixin’ A Hole: Recent Attempts by the European Community to Preserve the Ozone Layer*, 17 B.C. INT’L & COMP. L. REV. 165, 168 (1994); Jeffrey J. Renzulli, *The Regulation of Ozone-Depleting Chemicals in the European Community*, 14 B.C. INT’L & COMP. L. REV. 345, 347 (1991).

⁵⁷ David A. Wirth, *A Matchmaker’s Challenge: Marrying International Law and American Environmental Law*, 32 VA. J. INT’L L. 377, 384 (1992).

⁵⁸ Ling, *supra* note 47, at 94–95.

⁵⁹ Gallagher, *supra* note 27, at 275.

⁶⁰ Nangle, *supra* note 28, at 545.

⁶¹ Gallagher, *supra* note 27, at 274–75; Landers, *supra* note 10, at 462.

⁶² See Gallagher, *supra* note 27, at 274.

⁶³ Sean Cumberlege, *Multilateral Environmental Agreements: From Montreal to Kyoto—A Theoretical Approach to an Improved Climate Change Regime*, 37 DENV. J. INT’L L. & POL’Y 303, 312 (2009). The Montreal Protocol’s procedural framework has been exalted as a model for other international environmental agreements. See Chris Peloso, *Crafting an International Climate*

work to regulate the consumption of CFCs.⁶⁴ First, the treaty required that five of the most harmful CFCs be reduced to 1986 consumption levels.⁶⁵ Second, the treaty created a timetable for a gradual fifty percent reduction of CFC consumption by the year 2000.⁶⁶ To verify compliance, Article 7 of the Montreal Protocol requires countries to annually provide the Secretariat of the UNEP with statistical data on their production, imports, and exports of CFCs.⁶⁷ The treaty also included a provision to promote further research

Change Protocol: Applying the Lessons Learned from the Success of the Montreal Protocol and the Ozone Depletion Problem, 25 J. LAND USE & ENVTL. L. 305, 306–07 (2010) (advocating to apply structural elements of the Montreal Protocol to existing agreements combat climate change caused by greenhouse gases); Olga Goldberg, Note, *Biodegradable Plastics: A Stopgap Solution for the Intractable Marine Debris Problem*, 42 TEX. ENVTL. L.J. 307, 308 (2012) (proposing an international agreement, modeled after the Montreal Protocol, to manage a field of debris in international waters known as the “Garbage Patch”); Theron A. Mehr, Comment, *International Technology Transfer: Constructing and Financing an Environmental Program*, 15 LOY. L.A. INT’L & COMP. L.J. 731, 742 (1993) (arguing for other international environmental regimes to adopt financial assistance infrastructure similar to the Montreal Protocol’s Multilateral Fund).

⁶⁴ Bruce Pasfield & Elise Paeffgen, *How to Enforce a Carbon Tax: Lessons from the Montreal Protocol and the U.S. Experience with the Ozone Depleting Chemicals Tax*, 14 VT. J. ENVTL. L. 389, 393 (2013). Command and control describes a model of regulation in which governmental bodies impose specific requirements on polluters, such as limits on pollution and emissions from individual sources. Rena I. Steinzor, *Reinventing Environmental Regulation: The Dangerous Journey from Command to Self-Control*, 22 HARV. ENVTL. L. REV. 103, 104 (1998). In the United States, this model has been prominent in federal environmental legislation. Michael A. Livermore, *Reviving Environmental Protection: Preference-Directed Regulation and Regulatory Ossification*, 25 VA. ENVTL. L.J. 311, 318 (2007). For instance, the Clean Water Act (“CWA”) utilizes a command and control model to mandate compliance with emissions levels based on a “best available technology” standard, with corresponding penalties for noncompliance. 33 U.S.C. § 1311(b)(2)(A) (2012); Michael P. Vandenbergh, *From Smokestack to SUV: The Individual as Regulated Entity in the New Era of Environmental Law*, 57 VAND. L. REV. 515, 526 (2004). The Montreal Protocol’s model based on meeting specific production levels differs from a market-based best available technology standard, which adjusts emissions limits based on the capacity of existing emissions technology available for a particular source. Thoms, *supra* note 46, at 810; Michael P. Vandenbergh, *An Alternative to Ready, Fire, Aim: A New Framework to Link Environmental Targets in Environmental Law*, 85 KY. L.J. 803, 834 (1997); see 33 U.S.C. § 1311(b)(2)(A).

⁶⁵ Montreal Protocol, *supra* note 2, at art. 2; Thoms, *supra* note 46, at 802. The five most harmful CFCs that were in this most aggressive reduction schedule were CFCs 11, 12, 13, 113, 114, and 115. Montreal Protocol, *supra* note 2, at art. 2, annex A; Thoms, *supra* note 46, at 802 n.33.

⁶⁶ Montreal Protocol, *supra* note 2, at art. 2; Thoms, *supra* note 46, at 802. CFCs are listed in Group I of two groups of ozone depleting substances (“ODSs”) scheduled for reduction in the Montreal Protocol. Montreal Protocol, *supra* note 2, at Annex A–F. Group I contains the most common ODSs, such as CFCs, hydrochlorofluorocarbons (“HCFCs”), and now the majority of hydrofluorocarbons, (“HFCs”), while Group II contains ODSs such as halons, which although are more dangerous for the ozone layer, are produced in far fewer quantities. Raicyk, *supra*, note 31, at 369; see Robert W. Hahn & Albert M. McGartland, *The Political Economy of Instrument Choice: An Examination of the U.S. Role in Implementing the Montreal Protocol*, 83 NW. U. L. REV. 592, 593 n.3 (1989) (describing the Montreal Protocol’s treatment of halons).

⁶⁷ Montreal Protocol, *supra* note 2, at art. 7; Gallagher, *supra* note 27, at 288.

and the ability to amend the banned substances list should new ozone depleting substances arise.⁶⁸

The Montreal Protocol also included specific concessions to address the unique needs of developing countries, known as Article Five Parties.⁶⁹ Specifically, developing countries that accepted the treaty received a ten-year deferral to meet the treaty's obligations, and were allowed to increase consumption of CFCs while working to decrease production.⁷⁰ This grace period provided developing nations with the opportunity to begin compliance, but made concessions for delays related to the developing countries' limited financial resources.⁷¹

Since its inception in 1987, the signatories have grown from twenty-four to nearly two hundred countries.⁷² The treaty has been updated five times as scientists have developed a greater understanding of ozone depletion.⁷³ Most recently, the parties ratified the Kigali Amendments, which incorporated HFCs into the broader framework of the Montreal Protocol.⁷⁴

⁶⁸ Cumberlege, *supra* note 63, at 312–13.

⁶⁹ Hurlbut, *supra* note 49, at 352; see *Article Five Parties Status*, U.N. ENV'T PROGRAMME OZONE SECRETARIAT, <http://ozone.unep.org/en/article-5-parties-status> [<https://perma.cc/FMP8-A5U9>].

⁷⁰ Gallagher, *supra* note 27, at 286. The original Montreal Protocol provided one qualification on developing countries to utilize the grace period solely “in order to meet [their] basic domestic needs.” ANITA MARGRETHE HALVORSSEN, *EQUALITY AMONG UNEQUALS IN INTERNATIONAL ENVIRONMENTAL LAW: DIFFERENTIAL TREATMENT FOR DEVELOPING COUNTRIES* 88 (1999).

⁷¹ Montreal Protocol, *supra* note 2, at art. 5, 10; Bafundo, *supra* note 9, at 464; Mark A. Drumbl, *Poverty, Wealth, and Obligation in International Environmental Law*, 76 TUL. L. REV. 843, 865–66 (2002); Alice L. Bodnar, Note, *NRDC v. EPA: Testing the Waters of the Constitutionality of Delegation to International Organizations*, 34 ECOLOGY L. Q. 895, 901–02 (2007).

⁷² *Treaties and Decisions: Status of Ratification*, U.N. ENV'T PROGRAMME OZONE SECRETARIAT, <http://ozone.unep.org/en/treaties-and-decisions/> [<https://perma.cc/F956-GUP9>].

⁷³ Thoms, *supra* note 46, at 804. The Montreal Protocol officially went into force on January 1, 1989, following formal ratification by twenty-nine countries, as well as the European Commission. Montreal Protocol, *supra* note 2, at art. 16; Pamela S. Chasek, *The Ozone Depletion Regime*, in *GETTING IT DONE: POSTAGREEMENT NEGOTIATION AND INTERNATIONAL REGIMES* 187, 195 (Bertram I. Spector & I. William Zartman, eds., 2003). In keeping with its goal of substantial reduction of CFCs based on international cooperation, the treaty did not go into effect until enough parties to represent at least two-thirds of global CFC consumers formally ratified the treaty. Chasek, *supra*, at 194–95. By the time the Montreal Protocol went into force, approximately eighty-three percent of global CFC consumers had formally ratified the agreement. *Id.* at 195.

⁷⁴ Kigali Amendment, *supra* note 12, at annex I; see *infra* notes 145–169 and accompanying text (outlining the provisions of the Kigali Amendment).

D. Incorporation of the Montreal Protocol into the American Statutory Framework

The United States has integrated its obligations under the Montreal Protocol into some of its environmental and tax statutes.⁷⁵ For example, Title VI of the Clean Air Act (“CAA”) made ozone protection a part of the American environmental protection framework and adapted the “command and control” model of the Montreal Protocol to the American law enforcement and tax systems.⁷⁶ Title VI divides ODSs into two classes.⁷⁷ Class I substances, which have a minimum ozone depletion potential of 0.2, are generally considered to be the most dangerous to the ozone layer.⁷⁸ Class II substances, which largely consist of later-generation chemicals such as hydrochlorofluorocarbons (“HCFCs”), are generally considered safer for the ozone than Class I substances.⁷⁹ Under 42 U.S.C. § 7671c, Congress set the timeframe for a reduction in the permissible production and consumption of Class I substances, with the deadline of January 1, 2000—on that date, possession of all Class I substances became unlawful.⁸⁰ For Class II substances, 42 U.S.C. § 7671d set forth an extended reduction schedule, with produc-

⁷⁵ Pasfield & Paeffgen, *supra* note 64, at 394; see Elspeth Faiman Hans, Note, *The Montreal Protocol in U.S. Domestic Law: A “Bottom Up” Approach to the Development of Global Administrative Law*, 45 N.Y.U. J. INT’L L. & POL’Y 827, 838 (2013).

⁷⁶ Pasfield & Paeffgen, *supra* note 64, at 394; see *Arkema, Inc. v. Envtl. Prot. Agency*, 618 F.3d 1, 3 (D.C. Cir. 2010) (outlining Title VI’s statutory scheme); Andrew D. Finkelman, *The Post-Ratification Consensus Agreements of the Parties to the Montreal Protocol: Law or Politics? An Analysis of Natural Resources Defense Council v. EPA*, 93 IOWA L. REV. 665, 681 (2008) (noting the addition of methyl bromide into the CAA following its incorporation into the Montreal Protocol); Steven J. Shimberg, *Stratospheric Ozone and Climate Protection: Domestic Legislation and the International Process*, 21 ENVTL. L. 2175, 2176 (1991) (explaining that the timing of the CAA’s passage intentionally predated the talks leading to the Montreal Protocol by only a few weeks).

⁷⁷ 42 U.S.C. § 7671a (2012); Adams, *supra* note 34, at 190–91.

⁷⁸ 42 U.S.C. § 7671a; Adams, *supra* note 34, at 191. The term “ozone depletion potential” refers to the numerical factor that describes the ability of a substance to destroy atmospheric ozone as compared to the baseline figure for CFC-11. 42 U.S.C. § 7671(10); see Kriangsak Kittichaisaree, *Using Trade Sanctions and Subsidies to Achieve Environmental Objectives in the Pacific Rim*, 4 COLO. J. INT’L ENVTL. L. & POL’Y 296, 321 n.87 (1993). The numerical factor of ozone depletion potential is based on a mass to kilogram ratio that incorporates the substance’s atmospheric lifetime, its molecular weight, and rate of dissociation in the atmosphere. 42 U.S.C. § 7671(10); Patrick Turley, *Ozone Depletion: International Protective Strategies and Implications*, 12 U. ARK. LITTLE ROCK L.J. 301, 305 n.37 (1990).

⁷⁹ 42 U.S.C. § 7671a; Jones, *supra* note 4, at 827. The same chemical companies that originally designed CFCs largely designed their replacements, as well. BRIAN J. GAREAU, FROM PRECAUTION TO PROFIT: CONTEMPORARY CHALLENGES TO ENVIRONMENTAL PROTECTION IN THE MONTREAL PROTOCOL 80 (2013). In fact, by 1988, DuPont had already patented multiple processes to design HFCs that would replace certain CFC counterparts. *Id.* at 81; see *Elf Atochem N. Am., Inc. v. LaRoche Indus., Inc.*, 85 F. Supp. 2d 336, 337 (D. Del. 2000) (litigating a patent dispute over one HFC developed as an alternative to CFCs in the wake of the Montreal Protocol).

⁸⁰ 42 U.S.C. § 7671c.

tion and consumption of the substances becoming completely unlawful after December 31, 2030.⁸¹

The United States also implemented a dual enforcement model through Title VI.⁸² Title VI makes Class I substances, like CFCs, “controlled substances” under the CAA.⁸³ This designation allows EPA to closely regulate the production, consumption, import, and export of such substances, and authorizes the United States government to impose criminal and civil penalties for violations.⁸⁴ In addition, the United States implemented an excise tax on CFCs.⁸⁵ This excise tax is progressive on producers and importers of CFCs, and between 1995 and 2016 the tax nearly tripled.⁸⁶ Congress enacted two exemptions to the CFC excise tax, however.⁸⁷ First, I.R.C. § 4662(e)(1)(A) provides an export exemption, which removes the excise tax for “sale[s] by the manufacturer or producer of [CFC–113] for export, or for resale by the

⁸¹ *Id.* § 7671d.

⁸² Jones, *supra* note 4, at 825, 828. The federal government made a concerted effort to inform the public about this enforcement model, as well as the negotiation process, on regular intervals throughout the negotiation process in Montreal. Hans, *supra* note 75, at 840–41. The Environmental Protection Agency (EPA) regularly published updates of the negotiation process in the Federal Register. *Id.*

⁸³ Pasfield & Paeffgen, *supra* note 64, at 395.

⁸⁴ Nangle, *supra* note 28, at 565. The CAA permits parallel civil and criminal proceedings in penalizing violations of Title VI. 42 U.S.C. § 7413(a)(3) (2012). 42 U.S.C. § 7413(b) outlines the possible civil penalties for violations of Title VI, which include fines of up to twenty-five thousand dollars per day for a violation. 42 U.S.C. § 7413(b); Nangle, *supra* note 28, at 565; C. Russell H. Shearer, *Practical Considerations in the Domestic Sale of CFCs and HCFCs*, NAT. RES. & ENV'T, Spring 1997, at 58, 62 (noting that under this statutory scheme, transacting for four canisters of a Class I CFC could risk a civil fine of up to one hundred thousand dollars per day). Congress outlined the possible criminal penalties for violations of Title VI and specified that violators can receive a sentence of up to five years and risk further fines. 42 U.S.C. § 7413(c)(1); *see* United States v. Alghazouli, 517 F.3d 1179, 1188 (9th Cir. 2008) (outlining the statutory and regulatory framework utilized in the conviction of an ODS smuggler); 40 C.F.R. § 82.4 (2016) (providing EPA's regulatory framework for the phaseout of ODSs and the timeline for prohibitions on production or import of ODSs).

⁸⁵ United States v. Shellef, 732 F. Supp. 2d 42, 45 (E.D.N.Y. 2010); Jones, *supra* note 4, at 828; *see* Mystica M. Alexander et al., *Sustainability & Tax Policy: Fixing a Patchwork of Policies with a Coherent Federal Framework*, 35 VA. ENVTL. L.J. 1, 27–28 (2016) (providing a brief overview of the ozone excise tax framework); Janet E. Milne, *Environmental Taxation in the United States: The Long View*, 15 LEWIS & CLARK L. REV. 417, 429–30 (2011) (presenting the ODS excise tax as a model for future environmental taxes); Jason Spitzer & Adam Rosner, *IRS Taking Firm Approach to Ozone-Depleting Chemical Excise Tax*, TAX ADVISER (July 1, 2010), <http://www.thetaxadviser.com/issues/2010/jul/clinic-story-01/> [<https://perma.cc/BQZ8-P3EJ>] (advising ODS producers on strategies for compliance with the excise tax).

⁸⁶ I.R.C. § 4681(b) (2012); Pasfield & Paeffgen, *supra* note 72, at 396; *Ozone Depleting Chemicals (ODC) Excise Tax Audit Techniques Guide*, INTERNAL REVENUE SERV., (July 26, 2016), <https://www.irs.gov/businesses/small-businesses-self-employed/ozone-depleting-chemicals-odc-excise-tax-audit-techniques-guide> [<https://perma.cc/M7WG-EMLA>].

⁸⁷ I.R.C. §§ 4662(e)(1)(A), 4682(d)(1) (2012).

purchaser to a second purchaser for export.”⁸⁸ Second, I.R.C. § 4682(d)(1) provides a recycling exemption for ODSs that had already been produced and were recovered from machinery or storage in the United States.⁸⁹

E. Unleashing a Black Market of Ozone-Depleting Chemicals

Despite its success, the Montreal Protocol did have one major unintended consequence: the rise of the illegal trafficking of CFCs.⁹⁰ Because the Montreal Protocol required phasing out the production of ozone depleting substances, the demand for existing CFCs rose exponentially, prompting illicit sales into developed nations, such as the United States.⁹¹ Domestic and international entities began conspiring to import CFCs into the United States, bypassing the CAA and the excise tax.⁹² By the late 1990s, containers of CFCs that cost thirty-five dollars to produce could be sold in the United States for upwards of five hundred dollars.⁹³ With this enticing profit margin, both importers and smugglers strove to import massive quantities of the illegal chemicals, with an estimate of over nine thousand tons of CFCs illegally entering the United States every year.⁹⁴ CFC smuggling is particularly strong from the world’s leading producer of refrigerant chemicals: China.⁹⁵ One U.N. report from 2013 estimated that 3700 tons of illegal re-

⁸⁸ *Id.* § 4662(e)(1)(A); *see id.* § 4682(d)(3)(A) (incorporating by reference I.R.C. § 4662(e)) (including the export tax exception from § 4662(e) in the taxation scheme for CFCs).

⁸⁹ *Id.* § 4682(d)(1). Only one case has considered what constitutes a recycled ODS for the purpose of this exemption. *See F.R.C. Int’l, Inc. v. United States*, 278 F.3d 641, 643–44 (6th Cir. 2002); Hans, *supra* note 75, at 844–45. In *F.R.C. International, Inc. v. United States*, the United States Court of Appeals for the Sixth Circuit affirmed a lower court’s decision, holding that imports of ODS recovered from machinery in China and shipped to the United States did not qualify for the recycling exemption. 278 F.3d at 643–44.

⁹⁰ Jones, *supra* note 4, at 830.

⁹¹ Bafundo, *supra* note 9, at 482.

⁹² DeSombre, *supra* note 3, at 65.

⁹³ Landers, *supra* note 10, at 472–73.

⁹⁴ *Id.* at 472; *see* Matthew L. Wald, *Group Sees Ozone Danger in Illicit Chemical Trade*, N.Y. TIMES (Sept. 17, 1995), <http://www.nytimes.com/1995/09/17/us/group-sees-ozone-danger-in-illicit-chemical-trade.html> [<https://perma.cc/HL6J-Q4RH>] (noting CFC smuggling concerns in the United States).

⁹⁵ Jonathan M. Winer, *Globalization, Terrorist Finance, and Global Conflict: Time for a White List?*, 4 EUR. J. L. REFORM 255, 266 n.17 (2002); Landers, *supra* note 10, at 477. In recent years, the Chinese government has fulfilled its diplomatic responsibilities under the Montreal Protocol more actively, ranging from the symbolic (hosting the Meeting of Parties in 1999) to the substantive (openly supporting negotiations to include HFCs in the Montreal Protocol framework). Stephen O. Anderson & Ian J. Porter, *Chinese Political, Social and Economic Leadership in Protection of the Stratospheric Ozone Layer, Climate, and Biosecurity: A Montreal Protocol Case Study*, PROCEDIA—SOC. & BEHAV. SCI., Apr. 2013, at 237, 242.

frigerant chemicals were exported from China and East Asia every year, worth more than sixty-eight million dollars.⁹⁶

Smugglers took advantage of the deficient customs enforcement schemes to import the illegal chemicals.⁹⁷ For instance, smugglers deliberately mislabeled the contents of imported substances to bypass regulators and inspectors.⁹⁸ The CAA's CFC amendments require accurate labeling of Class I and Class II substances, as well as products containing Class I substances.⁹⁹ Smugglers circumvented the CAA's ozone-depleting substances regulations by falsely labeling unused chemicals as "recycled" to forego excise tax requirements for virgin CFCs.¹⁰⁰ Both of these tactics require little expertise, labor, or cost on the part of fabricators, and customs officials cannot easily differentiate between virgin and recycled CFCs.¹⁰¹ Furthermore, because CFCs are odorless gases stored in containers similar to other industrial gases, it is difficult for customs agents or other officials to verify the contents of a container.¹⁰²

In addition to falsely labeling the contents of shipments containing CFCs, smugglers have imported ozone-depleting chemicals into the United States through false transshipment reports.¹⁰³ This method of fraud involves smugglers shipping the CFC containers to American ports with false bills of lading, which falsely state that the containers are in transit to a foreign destination.¹⁰⁴ These containers never reach their listed destinations.¹⁰⁵ Instead, they remain in the United States, ready to be distributed to buyers without paying any excise tax.¹⁰⁶

Similarly, smugglers have used complicated shipping routes to obfuscate the contents of shipping containers through a process called triangula-

⁹⁶ U.N. OFFICE ON DRUGS & CRIME, TRANSNATIONAL ORGANIZED CRIME IN EAST ASIA AND THE PACIFIC: A THREAT ASSESSMENT 104 (2013), https://www.unodc.org/documents/data-and-analysis/Studies/TOCTA_EAP_web.pdf [<https://perma.cc/3WJM-NBK2>]; Nussbaum, *supra* note 6, at 3375; see U.N. ENV'T PROGRAMME, ILLEGAL TRADE IN OZONE DEPLETING SUBSTANCES: ASIA AND PACIFIC REGION 16–17 (2007), <http://www.unep.fr/ozonaction/information/mmcfiles/6075-e-illegal-trade-asia.pdf> [<https://perma.cc/5WJL-NFVQ>] (providing some instances of Chinese law enforcement's increased efforts to combat transnational smuggling of illegal chemicals).

⁹⁷ Landers, *supra* note 10, at 473.

⁹⁸ *Id.*

⁹⁹ 42 U.S.C. § 7671j(b) (2012). Specifically, the label must feature a warning label that states: "Contains [regulated substance], a substance which harms public health and environment by destroying ozone in the upper atmosphere." *Id.*

¹⁰⁰ Pasfield & Paeffgen, *supra* note 64, at 399.

¹⁰¹ *Id.*

¹⁰² Saab, *supra* note 8, at 653.

¹⁰³ Pasfield & Paeffgen, *supra* note 64, at 400.

¹⁰⁴ Saab, *supra* note 8, at 649.

¹⁰⁵ *Id.*

¹⁰⁶ *Id.*

tion.¹⁰⁷ In triangulation, shipping containers are sent to a developing country producing CFCs, fraudulently loaded with the chemicals while labeled as another product, and then returned to the United States.¹⁰⁸ Through these methods, smugglers and consumers of CFCs can reap massive benefits by circumventing the excise tax.¹⁰⁹

F. Domestic and International Responses to CFC Smuggling

The majority of illegal CFCs coming into the United States were produced in developing nations that were parties of the Montreal Protocol.¹¹⁰ While developed nations could bear the cost of investing in CFC substitutes and retrofitting equipment to comply with the Montreal Protocol, developing countries required financial assistance.¹¹¹ This financial strain provided a major conflict for developing nations, as worldwide demand for CFCs remained, but wealthier nations stopped production.¹¹² Major developing countries, including India and China, expressed dissatisfaction with the level of assistance they received from developed countries.¹¹³ In response to these criticisms, the ninety-six attending nations of the Second Meeting of the Parties to the Montreal Protocol negotiated additional financial support mechanisms that were implemented through amendments to the agreement.¹¹⁴

¹⁰⁷ Bafundo, *supra* note 9, at 484–85.

¹⁰⁸ Pasfield & Paeffgen, *supra* note 64, at 400.

¹⁰⁹ DeSombre, *supra* note 3, at 65.

¹¹⁰ See Bafundo, *supra* note 9, at 481–82.

¹¹¹ Ling, *supra* note 47, at 110.

¹¹² DeSombre, *supra* note 3, at 63–64.

¹¹³ Ling, *supra* note 47, at 96–97. Indian Environmental Minister Maneka Gandhi specifically expressed frustration with the fact that the majority of intellectual property for ozone-friendly technologies belongs to American and European corporations, forcing developing countries to pay for access to these technologies that are necessary for compliance. BENEDICK, *supra* note 52, at 189. Nonetheless, the Indian and Chinese representatives ultimately agreed in London that their nations would join the Montreal Protocol, thereby fulfilling a major goal for the organizers of the Second Meeting. Dale S. Bryk, *The Montreal Protocol and Recent Developments to Protect the Ozone Layer*, 15 HARV. ENVTL. L. REV. 275, 287–88 (1991); see David D. Caron, *Protection of the Stratospheric Ozone Layer and the Structure of International Environmental Lawmaking*, 14 HASTINGS INT'L & COMP. L. REV. 755, 761 (1991) (noting the emphasis non-Article Five countries had on including China and India in order for the Montreal Protocol to succeed).

¹¹⁴ Royal C. Gardner, *Exporting American Values: Tenth Amendment Principles and International Environmental Assistance*, 22 HARV. ENVTL. L. REV. 1, 34 (1998); see Mossos, *supra* note 55, at 25 (highlighting the need for a financial mechanism to aid developing countries prior to the adoption of the London Amendments). The London Amendments also added new CFCs and a series of other ODSs to the list of controlled substances. Joel A. Mintz, Comment, *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, 579 (1991). The chemicals added in London, while not CFCs, still had an adverse effect on the ozone layer in a manner similar to CFCs. Lori B. Talbot, Comment, *Recent Developments in the Montreal Protocol on Substances that Deplete the Ozone Layer: The June 1990 Meeting and Beyond*, 26 INT'L L. 145, 148–49 (1992).

The primary financial support mechanism for developing countries was the Montreal Protocol's Multilateral Fund, which subsidized the cost of retrofitting equipment and replacing CFCs in developing countries.¹¹⁵ The Multilateral Fund has largely been a successful mechanism for sponsoring global reduction in CFCs and other ODSs.¹¹⁶ As of July 16, 2016, the Multilateral Fund approved more than \$3.3 billion in funding for over 7600 ODS reduction projects in the developing world.¹¹⁷

In response to the illicit CFC trade, the United States and other developed nations set out to prosecute offenders and curb the illegal CFC trade.¹¹⁸ The United States formed an interagency task force with agents from EPA, U.S. Customs and Immigration Service, and the Internal Revenue Service.¹¹⁹ This joint interagency effort, dubbed "Operation Cool Breeze," and subsequently "Operation Catch-22" was largely successful, and in its first complete year of operation led to the seizure of over five hundred tons of illegal CFCs, valued at forty million dollars in lost tax revenue.¹²⁰

In addition to the arrest of CFC smugglers, the United States engaged in a hard tack of heavily prosecuting corporations and individuals that either facilitated the shipments or purchased them.¹²¹ The United States first successfully prosecuted a CFC smuggler in July 1995, when Adi Dara Dubash pleaded guilty in the United States District Court for the Southern District of Florida to illegally importing 8400 containers of CFCs.¹²² American law enforcement forces have even secured one extradition for a smuggler who

¹¹⁵ Drumbl, *supra* note 71, at 867–68.

¹¹⁶ *Id.*; see James A. Bove, *A Study of the Financial Mechanism of the Montreal Protocol on Substances that Deplete the Ozone Layer*, 9 ENVTL. L. 399, 410 (2003) (highlighting that, as of 2002, the Multilateral Fund approved nearly four thousand projects in 124 countries). *But see* Edith Brown Weiss, *The Five International Treaties, A Living History*, in ENGAGING COUNTRIES: STRENGTHENING COMPLIANCE WITH INTERNATIONAL ENVIRONMENTAL ACCORDS 89, 150–52 (Edith Brown Weiss & Harold K. Jacobson eds., 1998) (noting that the Multilateral Fund had initial difficulties both securing funding from developed countries and approving projects presented by developing countries).

¹¹⁷ U.N. Env't Programme, *Report of the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol to the Twenty-Eighth Meeting of the Parties*, ¶ 24, U.N. Doc. UNEP/OzL.Pro.28/10 (July 16, 2016).

¹¹⁸ Saab, *supra* note 8, at 650.

¹¹⁹ Landers, *supra* note 10, at 474.

¹²⁰ Jennifer Clapp, *The Illegal CFC Trade: An Unexpected Wrinkle in the Ozone Protection Regime*, 9 INT'L ENVTL. AFF. 259, 267 (1997); Press Release, Env'tl. Prot. Agency, Miami Man Sentenced to 18 Months in Prison for Smuggling Refrigerant (July 29, 2011), https://archive.epa.gov/epapages/newsroom_archive/newsreleases/09f9aa1eb2ccea9852578dc0053adc6.html [https://perma.cc/W7LJ-CK5X].

¹²¹ See Saab, *supra* note 8, at 650.

¹²² Earl E. Devaney & Michael J. Penders, *A United States Perspective on Transboundary Investigations: Recent Cases and Essential Strategies for Interdiction of International Environmental Crime*, NAT'L ASS'N ATT'YS GEN.: NAT'L ENVTL. ENFORCEMENT J., June 1996, at 26, 31.

fled the United States to Costa Rica to escape prosecution for illegal CFC imports.¹²³ The prosecutions continued against businesses engaged in the purchase of smuggled CFCs.¹²⁴ Through this enforcement regime government officials have significantly diminished ODS smuggling in the United States.¹²⁵

G. The Next Generation of Chemicals: Reducing HFCs

The Montreal Protocol is approaching its third decade in force and, following the Kigali Amendment, will begin to facilitate global reduction of another refrigerant material: HFCs.¹²⁶ HFCs came into use following the removal of CFCs from commercial markets and have little effect on the ozone layer.¹²⁷ Unfortunately, though, HFCs do cause adverse environmental effects.¹²⁸ Despite their benefits in ozone reduction, HFCs, a type of greenhouse gas, are disastrous in terms of their global warming potential.¹²⁹

¹²³ Jones, *supra* note 4, at 833–34.

¹²⁴ See *id.* at 833.

¹²⁵ Pasfield & Paeffgen, *supra* note 64, at 397–98; For instance, following one cooperative investigation by EPA, the Internal Revenue Service (IRS), and the U.S. Customs and Immigration Service, federal prosecutors secured guilty pleas from four defendants for their involvement in a scheme that imported enough CFCs that would have otherwise warranted twenty-four million dollars in excise taxes. Press Release, U.S. Dep’t of Justice, Smugglers of Ozone Depleting CFCs Plead Guilty (Mar. 6, 2002), https://www.justice.gov/archive/opa/pr/2002/March/02_endr_129.htm [<https://perma.cc/5PWK-5HJ4>]. Similarly, in 2007 the president of one Florida chemical import corporation received a sentence of eighteen months in prison and \$10,000 in fines for importing \$1.4 million in ODSs over a three-month period. Press Release, *supra* note 120; see Lorraine Elliott, *Smuggling Networks and the Black Market in Ozone Depleting Substances*, in HAZARDOUS WASTE AND POLLUTION: DETECTING AND PREVENTING GREEN CRIMES 45, 49–50 (Tanya Wyatt ed., 2015) (noting concern for sustained demand for black-market ODSs in the developing world as it decreased in the United States and Europe).

¹²⁶ See Kennedy, *supra* note 14, at 25.

¹²⁷ Barbara A. Boczar, *Avenues for Direct Participation of Transnational Corporations in International Environmental Negotiations*, 3 N.Y.U. ENVTL. L.J. 1, 29 (1994). In addition to production for commercial use, HFCs have entered the atmosphere as a byproduct of some HCFCs. Daniel G. McCabe, Comment, *Resolving Conflicts Between Multilateral Environmental Agreements: The Case of the Montreal and Kyoto Protocols*, 18 FORDHAM ENVTL. L. REV. 433, 442 (2007).

¹²⁸ Boczar, *supra* note 127, at 29.

¹²⁹ Daniel Bodansky, *The United Nations Framework Convention on Climate Change: A Commentary*, 18 YALE J. INT’L L. 451, 518 (1993); Mark W. Roberts & Peter M. Grabel, *A Window of Opportunity: Combating Climate Change by Amending the Montreal Protocol to Regulate the Production and Consumption of HFCs and ODS Banks*, 22 GEO. INT’L ENVTL. L. REV. 99, 105 (2009). The term “global warming potential” refers to the capacity of a gas to contribute to the retention of heat in the earth’s atmosphere, measured by a ratio of the gas’s potential to trap heat as compared to an equal amount of carbon dioxide. Nicholas DiMascio, *Credit Where Credit is Due: The Legal Treatment of Early Greenhouse Gas Emissions Reductions*, 56 DUKE L.J. 1587, 1606 n.103 (2007). The unit is used to compare disparate GHGs by their impact on the specific issue of global warming. Harro van Asselt & Joyeeta Gupta, *Stretching Too Far? Developing Countries and the Role of Flexibility Mechanisms Beyond Kyoto*, 28 STAN. ENVTL. L.J. 311, 349

Various HFCs have over one thousand times the climate impact of equivalent amounts of carbon dioxide, with one particular strain 14,310 times more dangerous than carbon dioxide.¹³⁰ HFCs have the potential to create a disastrous effect on the atmosphere and at current usage levels risk of raising the Earth's temperature by approximately 0.5 degrees Celsius by 2100.¹³¹

The United States has already begun to phase out HFC use.¹³² In July 2015, EPA began enforcement of a new rule, which prohibits the use of HFCs when more environmentally sound alternatives exist, under its Significant New Alternatives Policy ("SNAP") program.¹³³ Furthermore, EPA has instituted a series of rules mandating strict reporting standards for the production of the potent greenhouse gas HFC-23.¹³⁴ In the final months of the Obama administration, EPA promulgated a rule incorporating HFCs into its regulatory framework for other ODSs used in refrigeration.¹³⁵ As of May,

n.165 (2009). The deterioration of HFCs in the atmosphere has also been linked to the presence of another potent greenhouse gas, tetrafluoromethane, which has a global warming potential of 6600 and remains in the atmosphere for fifty thousand years. Aaron M. Jubb et al., *An Atmospheric Photochemical Source of the Persistent Greenhouse Gas CF₄*, 42 GEOPHYSICAL RES. LETTERS 9505, 9505 (2015).

¹³⁰ INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE & TECH. & ECON. ASSISTANCE PANEL, IPCC/TEAP SPECIAL REPORT: SAFEGUARDING THE OZONE LAYER AND THE GLOBAL CLIMATE SYSTEM 8 (2005) [hereinafter IPCC/TEAP SPECIAL REPORT]; Daniel G. McCabe, *supra* note 127, at 443. The IPCC/TEAP report came as the result of cooperation between the Technology and Economic Assistance Panel, the research apparatus of the Montreal Protocol, and the Intergovernmental Panel on Climate Change, a research organization formed by the United Nations and the World Meteorological Organization with a mandate to compile and analyze research related to climate change. Jorge E. Vinuales, *Legal Techniques for Dealing with Scientific Uncertainty in Environmental Law*, 43 VAND. J. TRANSNAT'L L. 437, 488 (2010); Roberts & Grabiell, *supra*, note 129, at 104.

¹³¹ U.N. ENV'T PROGRAMME, FREQUENTLY ASKED QUESTIONS RELATING TO THE KIGALI AMENDMENT TO THE MONTREAL PROTOCOL I (2016), http://ozone.unep.org/sites/ozone/files/pdfs/FAQs_Kigali-Amendment.pdf [<https://perma.cc/YS82-W33U>] [hereinafter KIGALI AMENDMENT FAQ]; see Justin Worland, *Countries Reach Landmark Deal to Limit Global Warming from Air Conditioners*, TIME (Oct. 15, 2016), <http://time.com/4532377/climate-change-kigali-agreement-air-conditioners/> [<https://perma.cc/25G8-ECVX>] (summarizing the Kigali Amendment); David Doniger, *Countries Adopt Kigali Amendment to Phase Down HFCs*, NAT. RES. DEF. COUNCIL (Oct. 14, 2016), <https://www.nrdc.org/experts/david-doniger/countries-adopt-kigali-amendment-phase-down-hfcs> [<https://perma.cc/7JB6-MNAU>] (discussing preliminary expectations of the Kigali Amendment).

¹³² Roberts & Grabiell, *supra* note 129, at 128.

¹³³ 40 C.F.R. § 82.170 (2016). This rule is currently being challenged by HFC manufacturers before the United States Court of Appeals for the District of Columbia Circuit. Petition for Review, *Mexichem Fluor, Inc. v. Env'tl. Prot. Agency*, No. 15-1328 (D.C. Cir. Sept. 15, 2015); Order, *Mexichem Fluor, Inc. v. Env'tl. Prot. Agency*, No. 15-1328 (D.C. Cir. Dec. 13, 2016) (scheduling oral arguments for February 17, 2017); David Schultz, *Will Trump Attorneys Defend Obama Climate Regulation?*, 48 Env't Rep. (BNA) 273 (Feb. 8, 2017) (discussing the Trump Administration's potential handling of litigation relating to greenhouse gasses).

¹³⁴ 40 C.F.R. § 98.3 (2016).

¹³⁵ *Id.* §§ 82.150–82.169. Two chemical industry organizations are challenging this rule. See Petition for Review, *Air Permitting Forum v. Env'tl. Prot. Agency*, No. 17-01017 (D.C. Cir. Jan.

2017, the Trump administration had not issued any statements concerning the Kigali Amendment.¹³⁶

As it works towards reducing usage of HFCs in commercial products, the United States has also promoted research for more environmentally sound alternatives.¹³⁷ In response to international concerns about the feasibility of producing refrigerants with low global warming potential, the Department of Energy conducted research at Oak Ridge National Laboratory to study the viability of these replacements in high-temperature environments.¹³⁸ The final report from this research concluded that viable alternatives do exist for common HFCs, and these alternatives have lower risks of exacerbating global warming.¹³⁹

The international community has also progressed in both individual efforts to reduce HFC use.¹⁴⁰ For instance, Canada instituted mandatory reporting requirements for production, imports, and exports of HFCs to generate data on national use before an international agreement.¹⁴¹ Similarly, Japan's Fluorocarbon Recovery and Destruction Law mandates industry to report production, destruction, and storage of HFCs to the Japanese government to compile national statistics on HFC stockpiles and usage.¹⁴² Fur-

17, 2017); Petition for Review, Nat'l Env'tl. Dev. Ass'n Clean Air Project v. Env'tl. Prot. Agency, No. 17-01016 (D.C. Cir. Jan. 17, 2017); see also David Schultz, *EPA's Refrigerant Leak Regulations Challenged in Court*, 48 Env't Rep. (BNA) 112 (Jan. 20, 2017) (noting two lawsuits challenging the EPA's authority to regulate HFC leaks).

¹³⁶ John Siciliano, *Supporters of Global Coolants Deal Try to Stay Below Trump's Rader*, WASH. EXAMINER (May 8, 2017), <http://www.washingtonexaminer.com/supporters-of-global-coolants-deal-try-to-stay-below-trumps-rader/article/2622015> [<https://perma.cc/Q7NH-DQWC>].

¹³⁷ Ernest Moniz, *A Global Effort to Phase Down Hydrofluorocarbons*, U.S. DEP'T OF ENERGY (Oct. 15, 2015), <http://energy.gov/articles/global-effort-phase-down-hydrofluorocarbons> [<https://perma.cc/73BK-6CWC>]; see Press Release, Exec. Office of the President, Council on Env'tl. Quality, Fact Sheet: Obama Administration Partners with Private Sector on New Commitments to Slash Emissions of Potent Greenhouse Gases (Sept. 16, 2015), <https://www.whitehouse.gov/the-press-office/2014/09/16/fact-sheet-obama-administration-partners-private-sector-new-commitments> [<https://perma.cc/F24Y-FDFL>] (announcing private sector commitments to reduce greenhouse gas emissions and HFCs).

¹³⁸ Moniz, *supra* note 137.

¹³⁹ OMAR ABDELAZIZ ET AL., ALTERNATIVE REFRIGERANT EVALUATION FOR HIGH-AMBIENT-TEMPERATURE ENVIRONMENTS: R-22 AND R-410A ALTERNATIVES FOR MINI-SPLIT AIR CONDITIONERS, at xix (2015), https://energy.gov/sites/prod/files/2015/10/t27/bto_pub59157_101515.pdf [<https://perma.cc/N4E5-FYSC>]; Moniz, *supra* note 137; see *Climate-Friendly Alternatives to HFCs and HCFCs*, EUR. COMM'N, https://ec.europa.eu/clima/policies/f-gas/alternatives_en [<https://perma.cc/Z9JZ-A3CG>] (listing environmentally-friendly alternatives to HFCs and HCFCs).

¹⁴⁰ Roberts & Grabiell, *supra* note 129, at 118; Guus J.M. Velders et al., *The Large Contribution of Projected HFC Emissions to Future Climate Forcing*, 106 PROC. NAT'L ACAD. SCI. 10,949, 10,953 (2009).

¹⁴¹ Peter Menyasz, *Canada Requires Reporting HFC Production, Import, Export*, 39 Int'l Env't Rep. (BNA) 25 (Jan. 13, 2016).

¹⁴² Toshio Aritake, *Japan Outpacing its HFC Collection, Destruction Estimates*, 38 Int'l Env't Rep. (BNA) 1039 (Aug. 7, 2015).

thermore, in 2006, the European Commission instituted regulations that required all air-conditioned automobiles sold in member states to use refrigerants with a global warming potential of 150 or less beginning in 2011.¹⁴³ With these national restrictions in place, the parties to the Montreal Protocol were in position to craft a multilateral agreement to reduce HFCs.¹⁴⁴

H. The Kigali Amendment and Incorporation of HFCs into the Montreal Protocol

The most significant movement toward global reduction of HFCs will ultimately come through the amended Montreal Protocol.¹⁴⁵ On October 15, 2016, in Kigali, Rwanda, the parties to the Montreal Protocol agreed to a formal amendment to the Montreal Protocol that will dramatically reduce the spread and use of HFCs.¹⁴⁶ In adopting the Kigali Amendment, the parties agreed to include HFCs within the broader framework of the Montreal Protocol and to adopt a schedule for dramatic cuts to the production and consumption of HFCs.¹⁴⁷

The Kigali Amendment's primary change to the Montreal Protocol is the introduction of HFCs into the list of controlled substances that will be reduced over the coming decades.¹⁴⁸ The amendment will come into force on January 1, 2019, and will schedule a reduction of HFC production and

¹⁴³ Stella Papasavva & Stephen O. Andersen, *GREEN-MAC-LCCP(C), Life-Cycle Climate Performance Metric for Mobile Air Conditioning Technology Choice*, 30 ENVTL. PROGRESS & SUSTAINABLE ENERGY 234, 237 (2011).

¹⁴⁴ See Roberts & Grabiell, *supra* note 129, at 118.

¹⁴⁵ ENVTL. INVESTIGATION AGENCY, KIGALI AMENDMENT TO THE MONTREAL PROTOCOL: A CRUCIAL STEP IN THE FIGHT AGAINST CATASTROPHIC CLIMATE CHANGE 1–3 (2016), <https://eia-international.org/wp-content/uploads/EIA-Kigali-Amendment-to-the-Montreal-Protocol-FINAL.pdf> [<https://perma.cc/AH75-U398>] [hereinafter EIA BRIEFING]; *Countries Agree to HFC Amendment to Montreal Protocol*, INT'L CTR. FOR TRADE & SUSTAINABLE DEV. (Oct. 20, 2016), <http://www.ictsd.org/bridges-news/bridges/news/countries-agree-to-hfc-amendment-to-montreal-protocol> [<https://perma.cc/TZL9-QCFF>].

¹⁴⁶ Kigali Amendment, *supra* note 12, at annex I; Davenport, *supra* note 12. In November 2015, at the Twenty-Seventh Meeting of the Parties to the Montreal Protocol, the 197 signatory nations agreed to work towards a global phase-out of HFCs. *Montreal Protocol Parties Devise Way Forward to Protect Climate Ahead of Paris COP21*, U.N. ENV'T PROGRAMME (Nov. 6, 2015), <http://www.unep.org/newscentre/Default.aspx?DocumentID=26854&ArticleID=35543> [<https://perma.cc/ZSZ4-YC5H>]. Specifically, the parties agreed to a "Dubai Pathway," which entails amending the Montreal Protocol in 2016 to include HFC reduction. *Report of the Twenty-Seventh Meeting of the Parties to the Montreal Protocol*, *supra* note 12, at 25. The language of the final decision mandates that the parties "work within the Montreal Protocol to an HFC amendment in 2016 by first resolving challenges by generating solutions in the contact group on the feasibility and ways of managing HFCs during Montreal Protocol meetings." *Id.*

¹⁴⁷ EIA BRIEFING, *supra* note 145, at 1–3.

¹⁴⁸ *Id.* at 1.

consumption that is similar to the Montreal Protocol's grace period for CFC reduction.¹⁴⁹

The Kigali Amendment requires non-Article Five countries, such as the United States, to reduce their HFC production and consumption based on annual average use in 2011, 2012, and 2013.¹⁵⁰ By 2036, HFC production and consumption will be reduced to fifteen percent of the baseline.¹⁵¹ A select number of other countries, notably the Russian Federation, will operate on a delayed version of this timetable, starting in 2020, but will be moved to the same schedule as the other non-Article Five countries by 2029.¹⁵²

The Kigali Amendment also provides a bifurcated reduction schedule for Article Five Parties.¹⁵³ First, the majority of Article Five Parties were placed on a delayed reduction schedule using a baseline calculated based on annual average use from 2020 to 2022 and requiring gradual reduction to begin in 2024.¹⁵⁴ Ultimately the goal is for these countries to consume and produce up to twenty percent of their baseline by 2045.¹⁵⁵ With this timeline in place, Article Five Parties have the opportunity to reduce production and consumption in a manner that better accommodates their limited resources.¹⁵⁶

The Kigali Amendment made an exemption for Article Five Parties that are designated "high-ambient-temperature parties," a select group of states located in the Middle East and South Asia.¹⁵⁷ Specifically, these high-ambient-temperature parties were allowed a more lenient reduction schedule given the unique challenges to refrigeration that these, the hottest coun-

¹⁴⁹ KIGALI AMENDMENT FAQ, *supra* note 131, at 3. This start date is contingent upon at least twenty parties to the Montreal Protocol ratifying the Kigali Amendment by that date. Kigali Amendment, *supra* note 12, at 53. If twenty parties have not ratified the amendment by January 1, 2019, the will come into force ninety days after twenty parties ratify the amendment. *Id.*

¹⁵⁰ Kigali Amendment, *supra* note 12, at 49–50.

¹⁵¹ *Id.* at 49.

¹⁵² *Id.* at 31. These delayed non-Article Five countries are Belarus, Kazakhstan, the Russian Federation, and Tajikistan. *Id.* These countries will reduce their consumption to ninety-five percent of their baseline level from 2020 to 2024, sixty-five percent from 2025 to 2028, thirty percent from 2029 to 2033, twenty percent from 2034 to 2035, and will be reduced to fifteen percent of the baseline from 2036 and thereafter. *Id.* at 49.

¹⁵³ Kigali Amendment, *supra* note 12, at 49.

¹⁵⁴ *Id.*; KIGALI AMENDMENT FAQ, *supra* note 131, at 22.

¹⁵⁵ Kigali Amendment, *supra* note 12, at 49.

¹⁵⁶ *See id.*; EIA BRIEFING, *supra* note 145, at 3.

¹⁵⁷ Kigali Amendment, *supra* note 12, at 35. The high-ambient-temperature parties to the Kigali Amendment are Bahrain, India, the Islamic Republic of Iran, Iraq, Kuwait, Oman, Pakistan, and Saudi Arabia. *Id.* at 31. The parties to the Kigali Amendment defined these high-ambient-temperature countries as those countries that have averaged at least two months per year of peak temperatures above thirty-five degrees Celsius over a ten-year period. *Id.* at 35.

tries in the world, face.¹⁵⁸ The freeze on increased production is scheduled to stop from 2028 until 2031, and then consumption and production is supposed to decrease to fifteen percent of the baseline by 2047.¹⁵⁹ With this complete framework established, the parties to the Montreal Protocol each have their obligations delineated in the amended treaty.¹⁶⁰

The drafters and negotiators of the Kigali Amendment praised the final agreement, with former Secretary of State John Kerry proclaiming it “likely the single most important step we could take at this moment to limit the warming of our planet and limit the warming for generations to come.”¹⁶¹ Leaders of developing states, particularly those most vulnerable to the onset of global climate change, also praised the agreement for both its future impact and its accommodation of their financial needs.¹⁶² According to estimates, the ultimate effect of the Kigali Amendment will be to remove the equivalent of seventy million tons of carbon dioxide from the atmosphere, which should prevent global temperature increase.¹⁶³ With the agreement established, the next step for the parties to the Montreal Protocol will be to ensure enforcement of the terms, including the prevention of illicit HFC smuggling.¹⁶⁴

The reduction of HFCs from the global market is directly analogous to the CFC removal process not only because of their mutual status within the Montreal Protocol, but also because of their dominant status in the refrigerant market at the time of the agreements to cut back on them.¹⁶⁵ The primary similarity between CFCs and HFCs is that, just as CFCs were dominant in the market prior to the Montreal Protocol and were far more cost-effective than less potent alternatives, similarly HFCs are currently the pri-

¹⁵⁸ *Id.*; see Arunabha Ghosh, *Changing the Course of the Planet*, THE HINDU (Chennai) (Oct. 19, 2016), <http://www.thehindu.com/opinion/op-ed/Changing-the-course-of-the-planet/article16074917.ece> [<https://perma.cc/AUC4-QB4V>] (noting India’s concern with facing a disproportionate burden as a developing, highly urban state that also experiences high ambient temperatures).

¹⁵⁹ Kigali Amendment, *supra* note 12, at 49.

¹⁶⁰ *See id.*; EIA BRIEFING, *supra* note 145, at 3.

¹⁶¹ Davenport, *supra* note 12.

¹⁶² *The Kigali Amendment to the Montreal Protocol: Another Global Commitment to Stop Climate Change*, U.N. ENV’T PROGRAMME (Dec. 2016), <http://web.unep.org/africa/news/kigali-amendment-montreal-protocol-another-global-commitment-stop-climate-change> [<https://perma.cc/6FL7-HUEU>]; see *Nations Agree to Kigali Amendment: Largest Near-Term Temperature Reduction from Single Agreement*, INST. FOR GOVERNANCE & SUSTAINABLE DEV. (Oct. 15, 2016), <http://www.igsd.org/nations-agree-to-kigali-amendment-largest-near-term-temperature-reduction-from-single-agreement/> [<https://perma.cc/2C9M-P6UF>] (summarizing Kigali Amendment and its differing reduction schedules for developing countries).

¹⁶³ EIA BRIEFING, *supra* note 145, at 3; KIGALI AMENDMENT FAQ, *supra* note 131, at 1.

¹⁶⁴ *See* WHEELS IN MOTION, *supra* note 13, at 12–14.

¹⁶⁵ *See* 40 C.F.R. § 82.1 (2016); Roberts & Grabiell, *supra* note 129, at 111.

mary refrigerant chemical used across the globe, and there are no more affordable alternatives.¹⁶⁶

Although the use of HFCs has diminished in recent years within developed nations, particularly the United States, developing nations continue to use HFCs.¹⁶⁷ Furthermore, the high initial cost of retrofitting HFC-compatible equipment will incentivize smuggling of HFCs into the United States and throughout the developed world.¹⁶⁸ With the parties to the Montreal Protocol agreeing to the Kigali Amendment, the current challenge is to ensure the Montreal Protocol's continued success and to prevent the detrimental impact of illicit smuggling.¹⁶⁹

II. APPLYING THE LESSONS OF THE MONTREAL PROTOCOL AND SUBSEQUENT CFC SMUGGLING TO COMBAT THE ILLICIT TRADE OF HFCs

To preemptively impede a possible black market of hydrofluorocarbons ("HFCs") from entering the United States, domestic law enforcement officials should employ the approach that they belatedly used to confront

¹⁶⁶ Kigali Amendment, *supra* note 12, at 5–6. Other refrigerant chemicals that do not have the same greenhouse gas potential, such as ammonia, are gaining market share, and certain industry producers have independently developed their own HFC alternatives in an effort to become the leading distributors of refrigerants in a post-HFC market. EIA BRIEFING, *supra* note 145, at 2; see Alexander Ovodenko, *140 Countries Will Phase Out HFCs. What Are These and Why Do They Matter?*, WASH. POST (Nov. 3, 2016), https://www.washingtonpost.com/news/monkey-cage/wp/2016/11/03/140-countries-will-now-phase-out-hfcs-what-are-these-and-why-do-they-matter/?utm_term=.af487509c8a4 [<https://perma.cc/24L9-LDKG>] (explaining the effects of HFCs and their status under the Kigali Amendment); Hiroko Tabuchi & Danny Hakim, *How the Chemical Industry Joined the Fight Against Climate Change*, N.Y. TIMES (Oct. 16, 2016), <https://www.nytimes.com/2016/10/17/business/how-the-chemical-industry-joined-the-fight-against-climate-change.html> [<https://perma.cc/D8G3-JPSG>] (noting developments made by the companies Honeywell and the DuPont Chemical subsidiary, Chemours).

¹⁶⁷ Chris Johnston et al., *Climate Change: Global Deal Reached to Limit Use of Hydrofluorocarbons*, GUARDIAN (Oct. 15, 2016), <https://www.theguardian.com/environment/2016/oct/15/climate-change-environmentalists-hail-deal-to-limit-use-of-hydrofluorocarbons> [<https://perma.cc/2JM4-QHGX>] (noting the exponential rise in refrigeration in personal and corporate contexts in China and India); *Countries Agree to HFC Amendment to Montreal Protocol*, *supra* note 145.

¹⁶⁸ MINISTRY OF ENV'T, FOREST & CLIMATE CHANGE, ROUNDTABLE DISCUSSION ON PHASING DOWN HFCs IN INDIA: ROAD TO THE HFC AMENDMENT TO THE MONTREAL PROTOCOL 4 (2016), http://ceew.in/pdf/CEEW_NRDC_MOEFCC_Summary%20report%20of%20HFC%20workshop_3OCT16.pdf [<https://perma.cc/CA3Y-LJNZ>] (noting that Indian policymakers are balancing environmental necessity and the costs of reducing HFC production and consumption, including intellectual property costs and industrial work to retrofit equipment); *Countries Agree to HFC Amendment to Montreal Protocol*, *supra* note 145 (noting that the signatory nations to the Kigali Amendment have expressed interested in proactive cost reduction measures for developing nations).

¹⁶⁹ See WHEELS IN MOTION, *supra* note 13, at 12–14; Roberts & Grabiell, *supra* note 129, at 111.

chlorofluorocarbon (“CFC”) smuggling.¹⁷⁰ Aside from an instruction for the Multilateral Fund to include prevention of the illicit HFC trade in its budget allocation, the Kigali Amendment does not address the significant problem of smuggling, which may soon arise.¹⁷¹ That said, the United States and its fellow parties to the Montreal Protocol on Substances that Deplete the Ozone Layer (“Montreal Protocol”) still have opportunities to mitigate this threat using lessons learned from combatting CFC smuggling.¹⁷²

First, the United States must continue to ensure cooperation and the exchange of information amongst its law enforcement and environmental agencies.¹⁷³ Next, the United States and other non-Article Five states must monitor their fellow parties to the Montreal Protocol to ensure compliance and promote anti-smuggling efforts through the Multilateral Fund.¹⁷⁴ Next, the United States should press for the destruction of so-called “HFC Banks,” a potent source of the greenhouse gas.¹⁷⁵ The United States, when approaching this problem, will also benefit from examining its enactment of other environmental laws, both domestic and international.¹⁷⁶

A. Domestic Law Enforcement

Although EPA is primarily responsible for establishing regulations for reducing the use of ozone-depleting substance (“ODS”) under Title VI of the Clean Air Act (CAA), enforcing these regulations is a multi-agency effort.¹⁷⁷ EPA and Customs demonstrated this joint commitment in March 1996, when the two agencies signed a joint Memorandum of Understanding, agreeing to share information and resources to combat CFC smuggling.¹⁷⁸ The program was largely successful in halting new shipments of CFCs into the United States, and in 1997, the DOJ secured fifty criminal convictions and \$38.1 million in civil fines for CAA ozone violations.¹⁷⁹ Unfortunately, this joint commitment toward combating CFC smuggling only arose after thousands of tons of illegal ozone-depleting chemicals en-

¹⁷⁰ See Devaney & Penders, *supra* note 122, at 32.

¹⁷¹ See Kigali Amendment, *supra* note 12, at 32–33.

¹⁷² See Devaney & Penders, *supra* note 122, at 32.

¹⁷³ See *infra* notes 177–184 and accompanying text.

¹⁷⁴ See *infra* notes 185–216 and accompanying text.

¹⁷⁵ See *infra* notes 217–226 and accompanying text.

¹⁷⁶ See *infra* notes 227–232 and accompanying text.

¹⁷⁷ Saab, *supra* note 8, at 655.

¹⁷⁸ ARNOLD W. REITZE, JR., AIR POLLUTION CONTROL AND CLIMATE CHANGE MIGRATION LAW 454 (2d ed. 2010); Steven A Herman, *EPA, Customs Service Join Forces to Fight Air Pollution at the Border*, NAT'L ASS'N ATT'YS GEN. NAT'L ENVTL. ENFORCEMENT J., Apr. 1996, at 9, 9.

¹⁷⁹ REITZE, *supra* note 178, at 454.

tered the United States.¹⁸⁰ To prevent this outcome with HFCs, the United States should adopt a more anticipatory approach and foster interagency cooperation on this specific issue from the outset.¹⁸¹

In addition to a coordinated, multi-agency approach to combating HFC smuggling, American officials should continue to press for strong punishments for smugglers, specifically through the possibility of prison sentences for individuals and heavy fines for corporate violators.¹⁸² Under the CAA, violating Class I controlled substance regulations, carries both civil and criminal penalties.¹⁸³ These penalties can serve as significant disincentives for individuals to smuggle these substances and can actually encourage compliance with the CAA's ozone laws.¹⁸⁴

B. Strengthening International Obligations

In addition to combating HFC smuggling within the United States, policymakers must preemptively attack the illegal trade by hampering production of the chemicals, particularly in the developing world.¹⁸⁵ The original Montreal Protocol offered a lenient schedule for the reduction of CFC production by developing countries, specifically through a ten-year grace period before being held to the agreement's requirements.¹⁸⁶ In theory, this grace period was a mutually beneficial term of the Montreal Protocol for

¹⁸⁰ See Susan B. Meyer, *Is It Safe to Come Out Yet? The Tenth Anniversary of the Montreal Protocol*, 9 COLO. J. INT'L ENVTL. L. & POL'Y 226, 230 (1997).

¹⁸¹ See REITZE, *supra* note 178, at 454.

¹⁸² See Jones, *supra* note 4, at 835.

¹⁸³ Saab, *supra* note 8, at 647.

¹⁸⁴ See Kevin A. Gaynor & Thomas R. Bartman, *Criminal Enforcement of Environmental Laws*, 10 COLO. J. INT'L ENVTL. L. & POL'Y 39, 41 (1999). Environmental criminal statutes are largely intended to be deterrents, as they create strong negative incentives for violations both in individual and corporate capacities. See Charles J. Babbitt et al., *Discretion and the Criminalization of Environmental Law*, 15 DUKE ENVTL. L. & POL'Y F. 1, 59 (2004) (contending that environmental criminal law in the United States is primarily motivated by deterrence); Wesley D. Sherman, Note, *The Economics of Enforcing Environmental Laws: A Case for Limiting the Use of Criminal Sanctions*, 23 J. LAND USE & ENVTL. L. 87, 89–90 (2007) (describing how criminal penalties fit into a broader environmental regulatory scheme in the United States that is focused on deterrence). But see Michael M. O'Hear, *Sentencing the Green-Collar Offender: Punishment, Culpability, and Environmental Crime*, 95 J. CRIM. L. & CRIMINOLOGY 133, 250–55 (2004) (noting the difficulties of applying a deterrence approach to environmental criminal law). Furthermore, the current statutory framework creates opportunities for prosecutors and EPA officials to exercise discretion in determining the appropriate sanctions, civil or criminal, with which they may sanction offenders. See Nangle, *supra* note 28, at 565; see also David M. Uhlmann, *Prosecutorial Discretion and Environmental Crime*, 38 HARV. ENVTL. L. REV. 159, 214–15 (2014) (concluding that criminal sanctions for violations of environmental, including the Clean Air Act violations, have largely been applied only in serious cases, but civil penalties constitute the majority of sanctions).

¹⁸⁵ Bafundo, *supra* note 9, at 480.

¹⁸⁶ Gallagher, *supra* note 27, 286.

both developed and developing nations.¹⁸⁷ For developing nations, the grace period provided sufficient time to invest in new industrial equipment that complied with the Montreal Protocol, and allowed them to remain conscious of other pressing financial needs.¹⁸⁸ For wealthier nations, this grace period ensured the cooperation of developing nations, a crucial step in the success of the agreement.¹⁸⁹ Despite these intentions, the grace period had major unintended consequences, spurring the production of CFCs in developing countries for illegal export to the United States and the European Union.¹⁹⁰ Developing nations were producing CFCs at a far greater rate than they were consuming them domestically.¹⁹¹ By 1995, CFC production in Article Five countries had increased by 177% compared to 1985 production levels, but in that same period consumption increased by only forty-one percent.¹⁹²

The United States and other developed nations pressed for a reduced grace period duration similar to the five-year period they initially sought in the first Montreal Protocol negotiations.¹⁹³ In the aftermath of the original Montreal Agreement, the ten-year grace period provided sufficient time for developing countries to change their capacity for non-CFC chemicals; however, it also provided sufficient time for producers to illegally ship these illegal chemicals across the globe.¹⁹⁴ The Kigali Amendment did include extended grace periods for Article Five countries to reduce HFC production and consumption, specifically the five year delay on the freeze for most Article Five countries and the ten year delay for high-ambient-temperature Article Five countries.¹⁹⁵ While these terms will provide some challenges for combating HFC smuggling, they were also a key part of the negotiations with highly populated developing nations, particularly India, and ultimately

¹⁸⁷ DeSombre, *supra* note 3, at 70.

¹⁸⁸ Hurlbrut, *supra* note 49, at 353.

¹⁸⁹ Drumbl, *supra* note 71, at 866.

¹⁹⁰ Bafundo, *supra* note 9, at 481.

¹⁹¹ REITZE *supra* note 178, at 448.

¹⁹² *Id.*

¹⁹³ Victor Williams, *Ozone Depletion, Developing Countries, and Human Rights: Seeking Better Ground on Which to Fight for Protection of the Ozone Layer*, 10 J. NAT. RESOURCES & ENVTL. L. 83, 98 (1995). Developed countries pressed for a five-year grace period because developing countries represented a small fraction of CFC production and consumption compared to industrialized nations, and this differentiated timetable could lead to circumventing the Montreal Protocol by just shifting the site of CFC manufacturing to developing countries. BENEDICK, *supra* note 52, at 93–94. Eventually the developed nations acceded to the concerns of the developing nations, who argued that the five-year plan placed disproportionate financial pressure on them to comply, even though they had not been responsible for the proliferation of ODSs. Ling, *supra* note 47, at 96–97; see FRIEDRICH SOLTAU, *FAIRNESS IN INTERNATIONAL CLIMATE CHANGE LAW AND POLICY* 176 (2009).

¹⁹⁴ Bafundo, *supra* note 9, at 481–82.

¹⁹⁵ See Kigali Amendment, *supra* note 12, at 49; EIA BRIEFING, *supra* note 145, at 3.

ensure the participation of these countries in the Kigali Amendment.¹⁹⁶ Nonetheless, the extended grace periods will require policymakers to maintain their commitment to enforce international obligations and support developing countries through the Montreal Protocol's financial mechanisms.¹⁹⁷

With this delayed rollout of HFC reduction in the developing world, policymakers should cultivate enforcement mechanisms and provide greater financial assistance for developing nations.¹⁹⁸ Noncompliant nations have a variety of incentives not to comply with their obligations to reduce the use of ODS because they are driven by economic concerns that prioritize other domestic needs over environmental concerns.¹⁹⁹ Noncompliant nations may be motivated by the high difficulty of monitoring compliance in a large multilateral agreement such as the current Montreal Protocol.²⁰⁰ Furthermore, with 197 parties currently subject to the treaty, noncompliant nations may defect out of a belief that this will be unnoticed.²⁰¹ Currently, the Montreal Protocol contains three central responses to noncompliance: assistance,

¹⁹⁶ Davenport, *supra* note 12 (noting that a significant source of conflict in negotiations was the issue of which timetables to adopt for Article Five states); see Catherine Benson Wahlén, *Parties Amend Montreal Protocol to Include HFCs*, INT'L INST. FOR SUSTAINABLE DEV. (Oct. 17, 2016), <http://sdg.iisd.org/news/parties-amend-montreal-protocol-to-address-hfcs/> [<https://perma.cc/4DU7-JCV4>] (noting the contentious nature of the negotiations). The United States, in conjunction with Canada and Mexico, and India each submitted their own proposed amendments during the negotiation process. U.N. Env't Programme, *Proposed Amendment to the Montreal Protocol on Substances That Deplete the Ozone Layer Submitted by Canada, Mexico and the United States of America*, U.N. Doc. UNEP/OzL.Pro.28/5, annex I (Apr. 14, 2016); U.N. Env't Programme, *Proposed Amendment to the Montreal Protocol on Substances That Deplete the Ozone Layer Submitted by India*, U.N. Doc. UNEP/OzL.Pro.28/6, annex I (Apr. 14, 2016). *But see* Matt McGrath, *Climate Change: 'Monumental' Deal to Cut HFCs, Fastest Growing Greenhouse Gases*, BBC NEWS (Oct. 15, 2016), <http://www.bbc.com/news/science-environment-37665529> [<https://perma.cc/C9Q2-MGUT>] (noting that some critics of the Kigali Amendment expressed concern that these concessions to India and China will adversely impact the overall agreement); Messing, *supra* note 12, at 1.

¹⁹⁷ See Elizabeth P. Barratt-Brown, *Building a Monitoring and Compliance Regime Under the Montreal Protocol*, 16 YALE J. INT'L L. 519, 541–42 (1991).

¹⁹⁸ *Id.*

¹⁹⁹ Frischmann, *supra* note 51, at 796; see Jacob Katz Cogan, *Noncompliance and the International Rule of Law*, 31 YALE J. INT'L L. 189, 194 (2006) (noting the Montreal Protocol as one of multiple international agreements that have experienced noncompliance partially due to lack of capacity from developing states).

²⁰⁰ See Sunstein, *supra* note 2, at 62; George W. Downs & Michael A. Jones, *Reputation, Compliance, and International Law*, 31 J. LEGAL STUD. S95, S99–100 (2002) (arguing that states will be primarily motivated to comply with international agreements to preserve their reputations as compliant and to remain involved in future agreements). *But see* Gabriella Blum, *Bilateralism, Multilateralism, and the Architecture of International Law*, 49 HARV. INT'L L.J. 323, 356–57 (arguing that large, decentralized international agreements with robust monitoring mechanisms incentivize compliance).

²⁰¹ Sunstein, *supra* note 2, at 62.

cautions, and suspensions.²⁰² Yet, the parties within the Protocol have avoided the most serious option—a suspension—solely resorting to cautioning Russia in 1998 when it failed to meet its reporting requirements.²⁰³ In an HFC reduction scheme, the United States and other developed nations should retain the possibility of utilizing the noncompliance measures if a nation produces illegal chemicals in a way that fosters a black market.²⁰⁴

C. Utilize the Multilateral Fund to Promote Compliance and Anti-Smuggling Efforts

The United States and other industrialized nations must be strict towards noncompliant nations, but also provide adequate support to less developed nations.²⁰⁵ Less financially sound nations may object to a more stringent enforcement regime on grounds that it would inevitably punish these nations because they lack the financial and institutional resources to combat illicit chemical production.²⁰⁶ To assuage these concerns, the United States and other developed nations should simultaneously preserve and expand upon the Multilateral Fund.²⁰⁷ The Multilateral Fund can provide developing nations with HFC substitutes, retrofitting equipment, and other tools for phasing out HFCs.²⁰⁸ Furthermore, the Multilateral Fund allows developing nations to fulfill their Montreal Protocol commitments without

²⁰² O. Yoshida, *Soft Enforcement of Treaties: The Montreal Protocol's Noncompliance Procedure and the Functions of Internal International Institutions*, 10 COLO. J. INT'L ENVTL. L. & POL'Y 95, 117 (1999).

²⁰³ Tseming Yang, *International Treaty Enforcement as a Public Good: Institutional Deterrent Sanctions in International Environmental Agreements*, 27 MICH. J. INT'L L. 1131, 1144–45 (2006).

²⁰⁴ See Yoshida, *supra* note 202, at 117.

²⁰⁵ Ling, *supra* note 47, at 112; see Yoshida, *supra* note 202, at 117.

²⁰⁶ Bafundo, *supra* note 9, at 478 n.75.

²⁰⁷ See Bryan A. Green, *Lessons from the Montreal Protocol: Guidance for the Next International Climate Change Agreement*, 39 ENVTL. L. 253, 266–67 (2009). As of November 16, 2015 the Multilateral Fund had \$110 million dollars available for disbursement. U.N. Env't Programme, *Report of the Seventy-Fifth Meeting of the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol*, ¶ 23, U.N. Doc UNEP/OzL.Pro/ExCom/75/85 (Nov. 20, 2015). The Multilateral Fund is financed through voluntary contributions from parties that are not designated as Article Five countries, with apportionments based on a scale provided by the United Nations. Jason M. Patlis, Note, *The Multilateral Fund of the Montreal Protocol: A Prototype for Financial Mechanisms in Protecting the Global Environment*, 25 CORNELL INT'L L.J. 181, 200 (1992).

²⁰⁸ DeSombre, *supra* note 3, at 62. The Multilateral Fund disburses capital to developing countries through four implementing institutions: the United Nations Environment Programme, the United Nations Development Programme, the United Nations Industrial Development Organization, and the World Bank. DUNCAN BRACK, INTERNATIONAL TRADE AND THE MONTREAL PROTOCOL 18–19 (1996); *Implementing Agencies*, MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL, <http://www.multilateralfund.org/aboutMLF/ImplementingAgencies/default.aspx> [<https://perma.cc/7PFF-4DDJ>].

diverting limited financial resources from other purposes.²⁰⁹ The United States and other developed countries can also choose to allocate portions of the extra twenty-seven million dollars they have committed to the Multilateral Fund in exchange for implementation of the Kigali Amendment.²¹⁰ This financial mechanism encourages participation in the agreement, while also reducing the risks that environmental protection will be sacrificed because of limited resources.²¹¹

In addition to this monetary support, the United States should support developing nations in an HFC reduction scheme through technical and informational support to its global law enforcement and environmental protection agencies.²¹² The current Montreal Protocol framework has already encouraged some coordination between multinational law enforcement agencies.²¹³ For instance, the International Criminal Police Organization (“INTERPOL”)’s Working Group on Environmental Crime has organized information sharing between domestic law enforcement agencies across the globe.²¹⁴ INTERPOL was a key conduit to the arrest and eventual extradition of one American smuggler.²¹⁵ This support and information-sharing scheme, however, should not begin with the search for violators of the chemical reduction protocol, but rather, should extend to expediting a reduction in manufacture in developing nations.²¹⁶

D. Reducing HFC Banks

In addition to combating the production of new HFCs, the parties of the Montreal Protocol should use its funding mechanisms to address HFC reserves, or banks.²¹⁷ These banks consist of chemicals that have been produced but are not currently in circulation and instead are either stored in tanks or in existing consumer products.²¹⁸ For instance, chemicals produced

²⁰⁹ Bove, *supra* note 116, at 410.

²¹⁰ See Press Release, White House Office of the Press Secretary, Leaders from 100+ Countries Call for Ambitious Amendment to the Montreal Protocol to Phase Down HFCs and Donors Announce Intent to Provide \$80 Million of Support (Sept. 22, 2016), <https://obamawhitehouse.archives.gov/the-press-office/2016/09/22/leaders-100-countries-call-ambitious-amendment-montreal-protocol-phase> [<https://perma.cc/J9UY-VYXF>]. In addition to the twenty-seven million dollars in state funds, a group of philanthropists dedicated fifty-three million dollars to support HFC reduction and energy efficiency in the developing world. *Id.*

²¹¹ See Green, *supra* note 207, at 266–67.

²¹² Saab, *supra* note 8, at 654.

²¹³ *Id.*

²¹⁴ Devaney & Penders, *supra* note 122, at 27.

²¹⁵ *Id.* at 32.

²¹⁶ Bafundo, *supra* note 9, at 491–92.

²¹⁷ Roberts & Grabiell, *supra* note 129, at 129.

²¹⁸ INST. FOR GOVERNANCE & SUSTAINABLE DEV., FREQUENTLY ASKED QUESTIONS ABOUT DESTROYING ODS BANKS UNDER THE MONTREAL PROTOCOL (ABBREVIATED VERSION) 1 (2009),

for the creation of foams and inside refrigeration machinery are retained in the foams or inside the refrigeration units.²¹⁹ Even after the production ends because of international agreements, the chemicals remain in circulation, particularly when they already exist in storage containers, and are at risk of being smuggled across the globe.²²⁰ In addition to halting another source of HFCs from entering the global black market, the coordinated targeting of existing banks will have the ancillary benefit of reducing the amount of greenhouse gases from the global environment.²²¹

While the Kigali Amendment does not include any provisions on the regulation of HFC banks, there is opportunity to reduce stored HFCs through the Montreal Protocol's financial and technological assistance programs.²²² Wealthier nations should utilize the positive reinforcement mechanisms within the Montreal Protocol to regulate existing banked HFCs.²²³ Specifically, developed nations within the Montreal Protocol should utilize the agreement's Multilateral Fund and disburse its funds for the purpose of financing a phase-out of HFC banks.²²⁴ At the moment, developing nations lack the capacity to finance the recovery of these banks, and they lack incentives to destroy existing equipment that is not subject to the Montreal Protocol.²²⁵ With financial incentives to recover stored HFCs and the resources to comply with this program, developing countries will have the ability to recover stored ODS banks and destroy them in a manner that does not cause further greenhouse gas emissions.²²⁶

E. Lessons from Other International Environmental Agreements

As the United States attempts to proactively prevent the illicit trade of HFCs following the Kigali Amendment, it should also look to incorporate lessons from other environmental smuggling issues, specifically trades in hazardous waste and endangered species.²²⁷ For instance, enforcement of

<http://www.igsd.org/documents/IGSDODSBanksFAQGenevaJuly2009abbreviatedversion.pdf> [<https://perma.cc/R69J-7Y6Y>] [hereinafter ODS BANK FAQ]; TECH. & ECON. ASSESSMENT PANEL, U.N. ENV'T PROGRAMME, TASK FORCE DECISION XX/7—INTERIM REPORT 9 (2009), <http://www.cetesb.sp.gov.br/wp-content/uploads/sites/31/2014/04/teap-june-2009-decisionXX-7-task-force-report.pdf> [<https://perma.cc/B23N-Q2DQ>].

²¹⁹ ODS BANK FAQ, *supra* note 218, at 1.

²²⁰ Donald Kaniaru et al., *Strengthening the Montreal Protocol: Insurance Against Abrupt Climate Change*, 7 SUSTAINABLE DEV. L. & POL'Y, Winter 2007, at 3, 5–6.

²²¹ See Roberts & Grabiell, *supra* note 129, at 129.

²²² *Id.* at 131–32.

²²³ *Id.*

²²⁴ *Id.* at 138. This policy could also conceivably be expanded to fund the destruction of existing CFC reserves as well. Kaniaru et al., *supra* note 220, at 4.

²²⁵ Kaniaru et al., *supra* note 220, at 4–5.

²²⁶ See Roberts & Grabiell, *supra* note 129, at 138.

²²⁷ Clapp, *supra* note 120, at 269.

the federal Resource Conservation and Recovery Act (“RCRA”) contains provisions permitting joint state and federal cooperation toward managing hazardous waste removal, including the construction and maintenance of waste treatment facilities.²²⁸ This joint state and federal monitoring and enforcement mechanism could be incorporated into an HFC reduction scheme, with federal agencies working with state counterparts to increase awareness of the signs of smuggling, and even to cooperate in the replacement and destruction of existing HFCs.²²⁹

Furthermore, under the Convention on International Trade in Endangered Species of Wild Flora and Fauna (“CITES”), the United States issued trade sanctions against another nation for violating an international agreement that regulates the trade of endangered species.²³⁰ In 1994, the United States formally issued trade sanctions against Taiwan for violating CITES.²³¹ The experience of the United States sanctioning a defector from an international environmental treaty in this instance demonstrates that there is a possibility of doing so again in the case of countries that deviate from an HFC agreement.²³²

F. Consequences of Inaction

If the United States and the international community fail to prevent an illicit trade in HFCs, the results would be dangerous for the global environment, the prevention of illegal behavior, and the legitimacy of multilat-

²²⁸ Jason M. Levy, *Conflicting Enforcement Mechanisms Under RCRA: The Abstention Battleground Between State Agencies and Citizen Suits*, 39 *ECOLOGY L.Q.* 373, 377 (2012).

²²⁹ *See id.*

²³⁰ Ruth A. Braun, Note, *Lions, Tigers and Bears [Oh My]: How to Stop Endangered Species Crime*, 11 *FORDHAM ENVTL. L.J.* 545, 557 (2000).

²³¹ *Id.* at 557; *see* Amy E. Vulpio, *From the Forests of Asia to the Pharmacies of New York City: Searching for a Safe Haven for Rhinos and Tigers*, 11 *GEO. INT’L ENVTL. L. REV.* 463, 479–82 (1999). The Convention on International Trade in Endangered Species of Wild Flora and Fauna and the Montreal Protocol share other similarities. Gary D. Meyers & Kyla Seligsohn Bennett, *Answering “The Call of the Wild”: An Examination of U.S. Participation in International Wildlife Law*, 7 *PACE ENVTL. L. REV.* 75, 101 (1989). For instance, both can add items to the list of prohibited chemicals or organisms through amendments approved by the signatory states. *Id.* Similarly, both treaties elicited their own respective black markets of banned substances. Jonathan P. Kazmar, *The International Illegal Plant and Wildlife Trade: Biological Genocide?*, 6 *U.C. DAVIS J. INT’L L. & POL’Y* 105, 107 (2000). The trade in illegal wildlife has continued despite international and domestic efforts to curb both imports and exports. Elizabeth R. Beardsley, *Poachers with PCs: The United States’ Potential Obligations and Ability to Enforce Endangered Wildlife Trading Prohibitions Against Foreign Traders Who Advertise on eBay*, 25 *UCLA J. ENVTL. L. & POL’Y* 1, 5 (2007). By 2006, the International Criminal Police Organization estimated that the global black market in wildlife was a six billion dollar annual industry. *Id.*

²³² *See* Edith Brown Weiss, *Understanding Compliance with International Environmental Agreements: The Baker’s Dozen Myths*, 32 *U. RICH. L. REV.* 1555, 1565 (1999).

eral agreements such as the Montreal Protocol.²³³ The continued proliferation of HFCs through illegal means would lead to the hazardous result of maintaining the presence of an efficient greenhouse gas in the atmosphere.²³⁴ Maintaining even some emission of these greenhouse gases is far from an ideal result of any international framework aiming to remove these chemicals from the atmosphere.²³⁵

In addition to hampering the environmental progress made by the Montreal Protocol, climate change agreements, and legislation, failure to combat a black market in HFCs would preserve a steady income stream for criminal enterprises.²³⁶ By the mid-1990s, a thirty-pound cylinder of CFCs, which could be purchased for thirty-five dollars in a developing nation, could be purchased for over five hundred dollars in the United States.²³⁷ With such high profit margins from illegal behavior, preventing the illicit import of ozone depleting chemicals into the United States will remove a lucrative source of income for potential lawbreakers.²³⁸ Furthermore, preservation of a global HFC black market would effectively punish law-abiding entities that pay higher prices for legal HFC replacements.²³⁹ As the spokesman for one industry group, the Alliance for Responsible Atmospheric Policy, stated, the financial incentive to purchase cheaper illegal substitutes “substantially discourag[ed] the shift to new materials or practices” following the Montreal Protocol.²⁴⁰

In addition to these concrete threats from not aggressively preventing HFC smuggling, a failed policy to prevent the black market would have an adverse impact on the legitimacy of an otherwise successful environmental agreement.²⁴¹ If legitimacy is viewed as the perceived success of a political regime, then the Montreal Protocol has largely established its legitimacy through sheer ability to achieve its stated goals reducing the level of global

²³³ See Roberts & Grabiell, *supra* note 129, at 108.

²³⁴ See Kaniaru et al., *supra* note 220, at 6.

²³⁵ See Roberts & Grabiell, *supra* note 129, at 102; see also Vincent Cable, *What is International Economic Security?*, 71 INT’L AFF. 305, 323 (1995) (arguing that because of the significant public health risks from ozone depletion, governments should approach CFC smuggling as a security risk).

²³⁶ See DeSombre, *supra* note 3, at 64.

²³⁷ Landers, *supra* note 10, at 472–73.

²³⁸ See *id.*

²³⁹ Jones, *supra* note 4, at 833.

²⁴⁰ *Id.* The Alliance for Responsible Atmospheric Policy is an association of refrigerant chemical producers that represents the industry in government relations concerning ozone and climate change policies. Malathi Nayak, *U.S. Companies Brace for Climate-Friendly Alternatives in Cooling Systems*, REUTERS (Oct. 16, 2016), <http://www.reuters.com/article/us-companies-climatechange-idUSKBN12H040> [<https://perma.cc/5R73-HL3B>].

²⁴¹ See Daniel Bodansky, *The Legitimacy of International Governance: A Coming Challenge for International Environmental Law?*, 93 AM. J. INT’L L. 596, 612 (1999).

CFCs and ameliorating atmospheric ozone levels.²⁴² Unfortunately, the persistent threat of a global black market may delegitimize the process of a multilateral regime such as the Protocol, and can possibly discourage future environmental efforts.²⁴³ If the global community wishes to continue the legacy of the Montreal Protocol through an HFC reduction, then it must continue to combat the global black market.²⁴⁴

CONCLUSION

In agreeing to the Kigali Amendment, the global community made a major step towards stemming the tide of climate change through the framework of one of the great environmental agreements of the modern era, the Montreal Protocol. As the United States and its international partners move toward a global reduction in the use of hydrofluorocarbons (“HFCs”), they will be making a significant step toward an international solution to an international problem. As the experience of the Montreal Protocol demonstrated, however, even the most successful environmental agreements can have unintended consequences, and entities willing to reduce costs through illegal means will attempt to bypass the law.

With the phase-out of chlorofluorocarbons (“CFCs”) from multilateral agreements came a wave of criminal activity, attempting to circumvent domestic and international laws by illegally smuggling CFCs into the United States. Ultimately, American law enforcement and environmental officials jointly coordinated efforts to halt shipments of illegal CFCs and prosecute offenders, but the delay still had serious consequences, preserving a black market in ozone depleting chemicals. This prevented full restoration of the atmospheric ozone layer, causing adverse effects on the environment and public health across the globe.

As the United States and other nations successfully expand the global ozone depleting substance regime to include HFCs, they have a significant opportunity to combat global warming through the reduction in a major greenhouse gas. Yet, a ban of chemicals such as HFCs in favor of other, expensive alternatives can risk provoking a new black market. Instead of solely reacting to an emergent black market in HFCs, American policymakers should emphasize preventing illicit ozone-depleting chemical production at the source, largely in the developing world. Through a combination of financial and informational support and clear penalties for noncompliance, the international community can work to reduce global dependence on

²⁴² Bafundo, *supra* note 9, at 464.

²⁴³ See David A. Wirth, *Legitimacy, Accountability, and Partnership: A Model for Advocacy on Third World Environmental Issues*, 100 YALE L.J. 2645, 2651 (1991).

²⁴⁴ See Bodansky, *supra* note 241, at 612.

HFCs. Within the United States, law enforcement and environmental protection forces can emphasize their unity to combating an initial wave of HFC smuggling, with stiff penalties for traffickers.

Global warming and ozone depletion are two global problems that inherently require multilateral cooperation for their solutions. In the case of HFC smuggling, the United States and its global partners will be best served by learning from the experience of combating CFC smuggling and preventing its rise proactively.