HFC Smuggling: Preventing the Illicit (and Lucrative) Sale of Greenhouse Gases

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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

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chemicals. The treaty’s massive reduction of legal CFCs, led to increased demand for an illegal replacement. 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.

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. Enterprising criminals capitalized on inefficiencies in federal and international enforcement mechanisms and imported the chemicals to buyers within the United States. 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. 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.

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. 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”). With the agreement to reduce HFCs comes the threat of smuggling...
of these chemicals. 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.

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

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. 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-
forts. This Note will then explain how the destruction of HFC “banks” can serve as a proactive measure against smuggling. 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. Finally, this Note will explain the consequences of inaction if the United States and the international community fail to adequately combat HFC smuggling. 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.

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. Within the stratosphere, ozone plays an essential role in the health of terrestrial ecosystems. These ozone molecules absorb ultraviolet (“UV”) radiation emitted by the sun. Although the UV rays dissolve the ozone compounds, the oxygen molecules largely reform into new ozone that can absorb further radiation. The process is largely stable, except when the ozone is broken apart by unnatural chemical compounds, such as chlorofluorocarbons (“CFCs”).

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.
29 Id.
30 Id. at 537.
Ozone’s UV-absorbing function is vitally important to both the preservation of aquatic and terrestrial ecosystems and to public health. Without a functioning ozone layer, the sun’s UV rays can penetrate the Earth’s atmosphere. 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.

In addition to the deleterious impacts on human health, UV radiation can have a strong adverse impact on the global environment. 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. 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. Fortunately for humans and all members of the terrestrial ecosystem, a functioning ozone layer provides protection from these dangers.

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...
industrial equipment.\textsuperscript{39} Frequently known by their brand name, Freon, CFCs are halocarbon compounds that combine with other halogen gases and vaporize at low temperatures.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{44} CFCs significantly threatened the protection provided by the ozone layer.\textsuperscript{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.\textsuperscript{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-

\textsuperscript{40} Adams, supra note 34, at 177; Jones, supra note 4, at 830 n.20.
\textsuperscript{41} Raiczyk, supra note 31, at 365.
\textsuperscript{42} Id. at 366.
\textsuperscript{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)
\textsuperscript{44} See Raiczyk, supra note 31, at 366.
\textsuperscript{45} Id.
ing with ozone molecules to break down the ozone.\textsuperscript{47} The disintegration of CFCs in the upper atmosphere released large quantities of chlorine atoms, which could destroy large quantities of ozone molecules.\textsuperscript{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.\textsuperscript{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").\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{53}

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

\textsuperscript{47} Bing Ling, Developing Countries and Ozone Layer Protection: Issues, Principles, and Implications, 6 TUL. ENVTL. L.J. 91, 93 (1992).
\textsuperscript{50} Ling, supra note 47, at 94. Ultimately, twenty countries and the European Community signed the Vienna Convention. Id.
\textsuperscript{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).
both individual and cooperative efforts to curb the problem.\textsuperscript{54} In 1977, the United States largely restricted the use of CFCs in aerosol spray cans following a report linking CFCs to ozone depletion.\textsuperscript{55} By 1982, Canada and the European Community instituted their own restrictions of CFCs in aerosols.\textsuperscript{56} Despite these individual efforts, ozone depletion remained a global issue with a global cause, and the international community sought a multilateral solution.\textsuperscript{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.\textsuperscript{58} In the interim period between Vienna and a new convention, the data continued to demonstrate a link between CFCs and ozone depletion.\textsuperscript{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.\textsuperscript{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.\textsuperscript{61} As international momentum to ban ODSs grew, so too did the scientific consensus that the regulations should begin with CFCs.\textsuperscript{62}

\textbf{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.\textsuperscript{63} The final treaty adopted a “command and control” frame-

\begin{itemize}
  \item \textsuperscript{55} 21 C.F.R. § 2.125 (2016); Elias Mossos, \textit{The Montreal Protocol and the Difficulty with International Change}, 10 ALB. L. ENVTL. OUTLOOK J. 1, 7 n.22 (2005).
  \item \textsuperscript{58} Ling, \textit{supra} note 47, at 94–95.
  \item \textsuperscript{59} Gallagher, \textit{supra} note 27, at 275.
  \item \textsuperscript{60} Nangle, \textit{supra} note 28, at 545.
  \item \textsuperscript{61} Gallagher, \textit{supra} note 27, at 274–75; Landers, \textit{supra} note 10, at 462.
  \item \textsuperscript{62} See Gallagher, \textit{supra} note 27, at 274.
  \item \textsuperscript{63} Sean Cumberlege, \textit{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, \textit{Crafting an International Climate
work to regulate the consumption of CFCs. First, the treaty required that five of the most harmful CFCs be reduced to 1986 consumption levels. Second, the treaty created a timetable for a gradual fifty percent reduction of CFC consumption by the year 2000. 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. The treaty also included a provision to promote further research...
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

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68 Cumberlege, supra note 63, at 312–13.
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 HALVORSEN, EQUALITY AMONG UNEQUALS IN INTERNATIONAL ENVIRONMENTAL LAW: DIFFERENTIAL TREATMENT FOR DEVELOPING COUNTRIES 88 (1999).
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-
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).
purchaser to a second purchaser for export.\footnote{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).} 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.\footnote{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.}

\section*{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.\footnote{Jones, supra note 4, at 830.} 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.\footnote{Bafundo, supra note 9, at 482.} Domestic and international entities began conspiring to import CFCs into the United States, bypassing the CAA and the excise tax.\footnote{DeSombre, supra note 3, at 65.} 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.\footnote{Landers, supra note 10, at 472–73.} 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.\footnote{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).} CFC smuggling is particularly strong from the world’s leading producer of refrigerant chemicals: China.\footnote{Id. at 472; see 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).} One U.N. report from 2013 estimated that 3700 tons of illegal re-
frigerant chemicals were exported from China and East Asia every year, worth more than sixty-eight million dollars.  

Smugglers took advantage of the deficient customs enforcement schemes to import the illegal chemicals.  For instance, smugglers deliberately mislabeled the contents of imported substances to bypass regulators and inspectors.  The CAA’s CFC amendments require accurate labeling of Class I and Class II substances, as well as products containing Class I substances.  Smugglers circumvented the CAA’s ozone-depleting substances regulations by falsely labeling unused chemicals as “recycled” to forego excise tax requirements for virgin CFCs.  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.  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.  

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.  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.  These containers never reach their listed destinations.  Instead, they remain in the United States, ready to be distributed to buyers without paying any excise tax.  Similarly, smugglers have used complicated shipping routes to obfuscate the contents of shipping containers through a process called triangula-

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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.
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. Through these methods, smugglers and consumers of CFCs can reap massive benefits by circumventing the excise tax.

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. 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. This financial strain provided a major conflict for developing nations, as worldwide demand for CFCs remained, but wealthier nations stopped production. Major developing countries, including India and China, expressed dissatisfaction with the level of assistance they received from developed countries. 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.

107 Bafundo, supra note 9, at 484–85.
108 Pasfield & Paefgen, 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).
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. The Multilateral Fund has largely been a successful mechanism for sponsoring global reduction in CFCs and other ODSs. 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.

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. The United States formed an interagency task force with agents from EPA, U.S. Customs and Immigration Service, and the Internal Revenue Service. 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.

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. 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. American law enforcement forces have even secured one extradition for a smuggler who

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115 Drumbl, supra note 71, at 867–68.
118 Saab, supra note 8, at 650.
119 Landers, supra note 10, at 474.
121 See Saab, supra note 8, at 650.
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_enrd_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.
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. 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.

The United States has already begun to phase out HFC use. 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. Furthermore, EPA has instituted a series of rules mandating strict reporting standards for the production of the potent greenhouse gas HFC-23. In the final months of the Obama administration, EPA promulgated a rule incorporating HFCs into its regulatory framework for other ODSs used in refrigeration. 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).


132 Roberts & Grabiel, supra note 129, at 128.


134 40 C.F.R. § 98.3 (2016).

2017, the Trump administration had not issued any statements concerning the Kigali Amendment.\textsuperscript{136}

As it works towards reducing usage of HFCs in commercial products, the United States has also promoted research for more environmentally sound alternatives.\textsuperscript{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.\textsuperscript{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.\textsuperscript{139}

The international community has also progressed in both individual efforts to reduce HFC use.\textsuperscript{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.\textsuperscript{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.\textsuperscript{142} Further
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

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


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.\footnote{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.}

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.\footnote{Id.} By 2036, HFC production and consumption will be reduced to fifteen percent of the baseline.\footnote{Kigali Amendment, supra note 12, at 49–50.} 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.\footnote{Id. at 49.}

The Kigali Amendment also provides a bifurcated reduction schedule for Article Five Parties.\footnote{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.} 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.\footnote{Id.; KIGALI AMENDMENT FAQ, supra note 131, at 22.} Ultimately the goal is for these countries to consume and produce up to twenty percent of their baseline by 2045.\footnote{Kigali Amendment, supra note 12, at 49.} 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.\footnote{See id.; EIA BRIEFING, supra note 145, at 3.}

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.\footnote{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.} Specifically, these high-ambient-temperature parties were allowed a more lenient reduction schedule given the unique challenges to refrigeration that these, the hottest coun-
tries in the world, face. 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. With this complete framework established, the parties to the Montreal Protocol each have their obligations delineated in the amended treaty.

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.” 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. 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. 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.

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. 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.; ELA BRIEFING, supra note 145, at 3.
161 Davenport, supra note 12.
163 ELA 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 & Grabel, supra note 129, at 111.
mary refrigerant chemical used across the globe, and there are no more affordable alternatives.\textsuperscript{166}

Although the use of HFCs has diminished in recent years within developed nations, particularly the United States, developing nations continue to use HFCs.\textsuperscript{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.\textsuperscript{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.\textsuperscript{169}

\textbf{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

\textsuperscript{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-hfc -s-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).

\textsuperscript{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.

\textsuperscript{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_MOECC_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).

\textsuperscript{169} See WHEELS IN MOTION, supra note 13, at 12–14; Roberts & Grabiel, supra note 129, at 111.
chlorofluorocarbon ("CFC") smuggling.\textsuperscript{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.\textsuperscript{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.\textsuperscript{172}

First, the United States must continue to ensure cooperation and the exchange of information amongst its law enforcement and environmental agencies.\textsuperscript{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.\textsuperscript{174} Next, the United States should press for the destruction of so-called "HFC Banks," a potent source of the greenhouse gas.\textsuperscript{175} The United States, when approaching this problem, will also benefit from examining its enactment of other environmental laws, both domestic and international.\textsuperscript{176}

\textit{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{179} Unfortunately, this joint commitment toward combating CFC smuggling only arose after thousands of tons of illegal ozone-depleting chemicals en-

\textsuperscript{170} See Devaney & Penders, supra note 122, at 32.
\textsuperscript{171} See Kigali Amendment, supra note 12, at 32–33.
\textsuperscript{172} See Devaney & Penders, supra note 122, at 32.
\textsuperscript{173} See infra notes 177–184 and accompanying text.
\textsuperscript{174} See infra notes 185–216 and accompanying text.
\textsuperscript{175} See infra notes 217–226 and accompanying text.
\textsuperscript{176} See infra notes 227–232 and accompanying text.
\textsuperscript{177} Saab, supra note 8, at 655.
\textsuperscript{178} ARNOLD W. REITZE, JR., \textit{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.
\textsuperscript{179} REITZE, supra note 178, at 454.
tered the United States.\textsuperscript{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.\textsuperscript{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.\textsuperscript{182} Under the CAA, violating Class I controlled substance regulations, carries both civil and criminal penalties.\textsuperscript{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.\textsuperscript{184}

\textbf{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.\textsuperscript{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.\textsuperscript{186} In theory, this grace period was a mutually beneficial term of the Montreal Protocol for

\begin{footnotesize}
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\item \textsuperscript{181} See REITZE, supra note 178, at 454.
\item \textsuperscript{182} See Jones, supra note 4, at 835.
\item \textsuperscript{183} Saab, supra note 8, at 647.
\item \textsuperscript{184} See Kevin A. Gaynor & Thomas R. Bartman, \textit{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., \textit{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, \textit{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, \textit{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, \textit{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).
\item \textsuperscript{185} Bafundo, supra note 9, at 480.
\item \textsuperscript{186} Gallagher, supra note 27, 286.
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both developed and developing nations. 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. For wealthier nations, this grace period ensured the cooperation of developing nations, a crucial step in the success of the agreement. 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. Developing nations were producing CFCs at a far greater rate than they were consuming them domestically. 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.

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. 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. 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. 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

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187 DeSombre, supra note 3, at 70.
188 Hurlbrut, supra note 49, at 353.
189 Drumb, 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. 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.

With this delayed rollout of HFC reduction in the developing world, policymakers should cultivate enforcement mechanisms and provide greater financial assistance for developing nations. 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. Noncompliant nations may be motivated by the high difficulty of monitoring compliance in a large multilateral agreement such as the current Montreal Protocol. Furthermore, with 197 parties currently subject to the treaty, noncompliant nations may defect out of a belief that this will be unnoticed. Currently, the Montreal Protocol contains three central responses to noncompliance: assistance, assistance, assistance.

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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. 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. 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.

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. 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. To assuage these concerns, the United States and other developed nations should simultaneously preserve and expand upon the Multilateral Fund. The Multilateral Fund can provide developing nations with HFC substitutes, retrofitting equipment, and other tools for phasing out HFCs. Furthermore, the Multilateral Fund allows developing nations to fulfill their Montreal Protocol commitments without

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204 See Yoshida, supra note 202, at 117.
205 Ling, supra note 47; see Yoshida, supra note 202, at 117.
206 Bafundo, supra note 9, at 478 n.75.
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 & Grabiel, 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.\textsuperscript{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.\textsuperscript{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 gasses from the global environment.\textsuperscript{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.\textsuperscript{222} Wealthier nations should utilize the positive reinforcement mechanisms within the Montreal Protocol to regulate existing banked HFCs.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{226}

\textbf{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.\textsuperscript{227} For instance, enforcement of

\textsuperscript{219} ODS BANK FAQ, supra note 218, at 1.
\textsuperscript{221} Id. at 131–32.
\textsuperscript{222} Id.
\textsuperscript{223} 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.
\textsuperscript{224} Kaniaru et al., supra note 220, at 4–5.
\textsuperscript{225} See Roberts & Grabiel, supra note 129, at 129.
\textsuperscript{226} See Roberts & Grabiel, supra note 129, at 138.
\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{230} In 1994, the United States formally issued trade sanctions against Taiwan for violating CITES.\textsuperscript{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.\textsuperscript{232}

\textbf{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-


\textsuperscript{229} See id.


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 & Grabiel, supra note 129, at 108.
234 See Kaniaru et al., supra note 220, at 6.
235 See Roberts & Grabiel, 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.
CFCs and ameliorating atmospheric ozone levels.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. 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.

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.
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.