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Montreal Protocol

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Montreal Protocol

DATE: Signed September 16, 1987; took effect January 1, 1989; amended 1990, 1992, 1995, 1997, and 1999

The Montreal Protocol was created to help preserve the Earth's ozone layer by severely limiting the production and use of chlorofluorocarbons (CFCs) and other halogenated compounds.

BACKGROUND

The Montreal Protocol on substances that deplete the ozone layer was signed in 1987 by forty-six nations, including the United States. It entered into force on January 1, 1989. The Montreal Protocol was designed to control the production and consumption of chlorofluorocarbons (CFCs) and other halogenated compounds that were suspected of causing the destruction of the ozone layer. Industrialized countries, such as the United States, were committed to freezing consumption of certain CFCs at 1986 levels by mid-1989 and to reducing 1986 consumption levels by 20 percent by mid-1993. By mid-1988, a 50 percent reduction in 1986 consumption levels was required by the terms of the protocol. Halons (such as CF_2BrCl , CF_3Br , and $\text{C}_2\text{F}_4\text{Br}_2$) were to be frozen at 1986 consumption levels in 1992.

As amended in 1990, the Montreal Protocol called for the total phaseout of specified CFCs, halons, and carbon tetrachlorides by the year 2000 and methyl chloroform by 1995. It also accelerated the rate at which the phaseout would be conducted for CFCs, calling for a 50 percent reduction by 1995, an 85 percent reduction by 1997, and a 100 percent reduction by 2000. The Kigali Amendment, in force in 2019, mandates large-scale phaseouts of hydrochlorofluorocarbons by 2047.

PROVISIONS

The Montreal Protocol is directed at protecting the ozone layer, a global natural resource 10 to 20 kilometers above the Earth's surface that screens out most of the ultraviolet radiation emitted by the Sun. Ultraviolet light can lead to mutations and cancers in living things. Participating nations were motivated to act by four major scientific events: In 1974, the mechanism by which CFCs deplete ozone was

demonstrated, which led the United States to ban CFCs in aerosols unilaterally in 1978; a "hole" in, or more correctly a thinning of, the ozone layer was discovered over Antarctica in the early 1980's; evidence linking the ozone hole to CFCs was provided in 1985; CFC substitutes were developed by important CFC producers such as the company DuPont.

The Montreal Protocol is one of the most successful environment protection agreements in the world. The protocol established a mandatory timetable for the phaseout of ozone-depleting substances. The following basic timetable has been under constant revision, with phaseout dates accelerated in accordance with scientific understanding and technological advances:

- *Chlorofluorocarbons (CFCs)*: phased out at the end of 1995 for developed countries and 2010 for developing countries.
- *Halons*: phased out at the end of 1993 for developed countries and 2010 for developing countries.
- *Carbon tetrachloride*: phased out at the end of 1995 for developed countries and 2010 for developing countries.
- *Methyl chloroform*: phased out at the end of 1995 for developed countries and 2015 for developing countries.
- *Hydrochlorofluorocarbons (HCFCs)*: freeze from beginning of 1996, 35 percent reduction by 2004, 75 percent reduction by 2010, 90 percent reduction by 2015, and total phaseout by 2020 for developed countries; freeze in 2013 at a base level calculated as the average of 2009 and 2010 consumption levels, 10 percent reduction by 2015, 35 percent reduction by 2020, 67.5 percent reduction by 2025, and total phaseout by 2030 for developing countries. Under the Kigali Amendment, in force as of 2019, parties to the Montreal Protocol are committed to global phaseout reductions of HCFCs by more than 80 percent by 2047, with developed countries phasing down production and consumption by 85% by 2036, and developing nations phasing down by 85% by 2046.

IMPACT ON RESOURCE USE

The major innovation of the Montreal Protocol was the call for a gradual reduction in CFC production and the allowance for adjustments in the members' activities based on updated scientific information.

Thus, the amended protocol in 1990 accelerated reduction levels because new data suggested that the extent of ozone destruction was greater than anticipated. However, an immediate total ban of CFCs would have been unworkable, because CFCs were crucial in important cooling and air-conditioning applications. In addition, without reasonably inexpensive alternatives to CFC use in air-conditioning, the distribution of temperature-sensitive medical supplies such as blood, 75 percent of food shipments, and the habitability of many workplaces dependent on air-conditioning would have been affected.

There has been some disagreement on the extent and effect of ozone depletion. Substantial arguments arose among the signers of the Montreal Protocol regarding the level of production cuts required to amend the problem. Disagreements also existed regarding the level of support that developing nations were entitled to in their efforts to do without CFCs. For them, compliance meant forgoing the benefits of CFCs (particularly for refrigeration) that industrialized countries had enjoyed at crucial phases in their economic growth. Eventually, compensation of at least \$350 million was set aside by industrialized countries to induce developing nations to eliminate their CFC production.

The Multilateral Fund for the Implementation of the Montreal Protocol provides funds to help developing countries phase out the use of ozone-depleting substances (ODS). ODS are used in refrigeration, foam extrusion, industrial cleaning, fire safety, and fumigation. The Multilateral Fund was the first financial mechanism to be created under an international treaty. It embodies the principle agreed upon at the 1992 United Nations Conference on Environment and Development (Earth Summit) that countries have a common but differentiated responsibility to protect and manage the global commons.

The fund is managed by the Humanitarian Affairs Executive Committee with an equal representation of seven industrialized and seven Article 5 countries, which are elected annually by a Meeting of the Parties. The committee, which reports annually to the Meeting of the Parties on its operations, was established by a decision of the Second Meeting of the Parties to the Montreal Protocol (London; June, 1990) and began its operation in 1991. The main objective of the Multilateral Fund is to assist developing country parties whose annual per-capita consumption and production of ODS is less than 0.3 kilogram

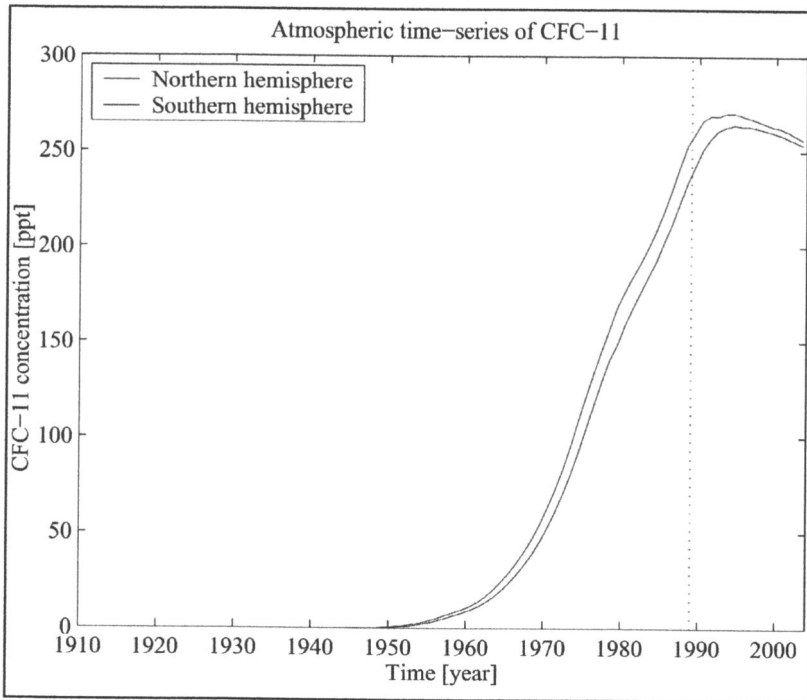
to comply with the control measures of the Montreal Protocol. As of 2009, 146 of the 194 parties to the Montreal Protocol had met these criteria. They are referred to as Article 5 countries.

Contributions to the Multilateral Fund from the industrialized countries, or non-Article 5 countries, are assessed according to the U.N. scale of assessment. The Fund has been replenished seven times: \$240 million (1991-1993), \$455 million (1994-1996), \$466 million (1997-1999), \$440 million (2000-2002), \$474 million (2003-2005), \$400 million (2006-2008), and \$400 million (2009-2011). The total budget for the 2009-2011 triennium was \$490 million: \$73.9 million of that budget was from the 2006-2008 triennium and \$16.1 million was provided from interest accruing to the Multilateral Fund during the 2009-2011 triennium. In 2008, the contributions made to the Multilateral Fund by forty-nine industrialized countries (including Countries with Economies in Transition, or CEIT) totaled more than \$2.4 billion. Projects and activities supported by the fund are implemented by four international agencies.

The Executive Committee has held fifty-six meetings since the establishment of the Multilateral Fund in 1990. During these meetings, the Executive Committee has approved the expenditure of more than \$2.3 billion to support more than six thousand projects and activities, which are to be implemented through the four implementing agencies and by bilateral agencies, in 148 countries.

The implementation of these projects will result in the phaseout of the consumption of more than 254,687 ODP tonnes (an ODP tonne is a non-substance-specific measure referring to ozone-depleting potential as compared to CFC-11, which has an ODP of 1.0) and the production of about 176,439 ODP tonnes of ozone-depleting substances. Of this total, about 230,786 ODP tonnes of consumption and 175,864 of production had been phased out from projects approved as of December, 2007.

To facilitate the phaseout by Article 5 countries, the Executive Committee has approved 141 country programs and has funded the establishment and the operating costs of ozone offices in 143 Article 5 countries. Funds are used to finance the conversion of existing manufacturing processes, train personnel, pay royalties and patent rights on new technologies, and establish National Ozone Offices. As of 2008, more than \$2.16 billion had been approved to support



The dotted line at 1989 indicates the time at which the Montreal Protocol on Substances That Deplete the Ozone Layer came into force. The data are plotted here using MATLAB. (Plumbago, via Wikimedia Commons)

more than fifty-five hundred projects and activities in 144 developing countries.

Each country enacts the provisions of the Montreal Protocol in specific ways. For example,

Australia has been a leading supporter of international efforts to protect the ozone layer since the early 1980's, when initial moves were made through the United Nations to limit the global release of ODS. As of March, 2009, Australia had ratified all the amendments to the protocol, which includes the Vienna Convention for the Protection of the Ozone Layer (1985) and the Montreal Protocol on Substances That Deplete the Ozone Layer (1987) and the following amendments to the protocol: London (1990), Copenhagen (1992), Vienna (1995), Montreal (1997), and Beijing (1999). Australia is a member of important decision-making bodies within the protocol framework, including the Implementation Committee, the Scientific Assessment Panel, and the Methyl Bromide Technical Options Committee. An active role in these areas allows Australia a degree of influence over the nature and direction of global ozone protection issues.

Although Australia accounts for less than 1 percent of global emissions of ODS, its participation in the protocol means that it meets international standards in full. For example, Australia implements its obligations under the Montreal Protocol through the Australian Ozone Protection and Synthetic Greenhouse Gas Management Act (1989), which states that all licenses to import or export ODS carry a condition that the licensee must import or export the substance only from or to a country that has ratified the Montreal Protocol and the relevant subsequent amendments. To help facilitate this, the appropriate government minister must maintain a Register of Montreal Protocol Countries and the substances for which those countries are to be treated as a Montreal Protocol country.

Australia has met or exceeded all of its phaseout obligations under the Montreal Protocol. For example, it will essentially phase out consumption of HCFCs by 2016, four years ahead of the schedule required under the protocol. In doing so, Australia will consume 61 percent less HCFCs in the period to 2020 than required under the Protocol, even after the Parties to the Montreal Protocol agreed in 2007 to advance HCFC phaseout globally.

Parties to the Montreal Protocol adopted a significant amendment in October 2016—the Kigali Amendment. The Kigali Amendment focuses on the role of HCFCs in climate change whereas the original Protocol focused on the ozone layer. HCFCs are organic compounds commonly used as refrigerant products in air conditioners and refrigerators as alternatives to ozone-depleting substances. Although they have no direct impact on the ozone layer, HCFCs are estimated to be hundreds of times more potent as greenhouse gases than carbon dioxide. The Kigali Amendment gained worldwide support, adopted by the 197 countries who are parties to the Protocol. Under the Kigali Amendment, in force as of 2019, parties to the Montreal Protocol commit to phaseout

reductions of HCFCs by more than 80 percent by 2047. Although the phaseout formulas, varying by group of countries, percentages, and timetables is complex, it can be summarized that developed countries will phase down production and consumption by 85% by 2036, and by 2046 for developing nations in exchange for financing. Amendment advocates estimated that adherence to amendment guidelines would prevent up to 80 billion tonnes CO₂ equivalent of emissions by 2050 and will be the largest contributor to keeping the global temperature below 2 degrees Celsius. As of January 2019 it is not clear whether President Donald Trump, who withdrew the United States from the 2015 Paris Agreement on climate change, will submit the Kigali Amendment to the U.S. Senate for ratification.

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updated by W. J. Maunder and Howard Bromberg

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