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# AN ANALYSIS OF THE LEGAL REGIMES FOR OZONE LAYER PROTECTION

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**Abstract**

*This paper analysed the vital legal framework governing ozone layer protection, primarily, the Vienna Convention for the Protection of the Ozone Layer and the effective Montreal Protocol on Substances that Deplete the Ozone Layer. The analysis covered the historical context, cooperative arrangements, and the complex interplay of actors in addressing the global challenge of ozone depletion. The study carefully examined the roles of developing and developed nations in implementing these legal instruments by interrogating the Canadian, South African and Nigerian contexts. It provided nuanced insight into their diverse approaches and problems faced at the national level. The research revealed the significant stride of the Montreal Protocol in curbing ozone-depleting substances. However, persistent challenges and emerging environmental threats such as global warming and climate change underscore the need for continued global efforts. The paper emphasized the need for continued international cooperation to ensure that the ozone layer fully recovers. It concluded by acknowledging the strides already made towards international cooperation while emphasising the urgency of collective action to address emerging challenges and evolving environmental concerns for a healthier planet.*

**Keywords**: Environmental Threat, Legal Regimes, Montreal Protocol, Ozone Depletion, Vienna Convention

## INTRODUCTION

Earth is the only planet where there is life in the universe. To protect the life on the earth a "protective shield called the "Ozone Layer" has been formed around the earth. Ozone occupies only 0.000007% of the total atmospheric gases by volume. Protecting the stratospheric ozone layer by controlling the production and use of ozone-depleting compounds has been an environmental concern since the mid-1970s when it was discovered that chlorine could potentially deplete the ozone layer. Not until significant losses of ozone were reported in 1985, however, did ozone depletion become an important international issue. The principal international policy instrument for protecting the stratospheric ozone layer is the Montreal Protocol on Substances that Deplete the Ozone Layer. This is because it is a great improvement on the Vienna Convention. Many countries, and even some cities and other sub-national authorities, have taken action to control the production and use of chlorofluorocarbons (CFCs) and other ozone-depleting substances. Much of the National/Sub-national Ozone Policy Formulation is in response to the Montreal Protocol, although several countries had taken steps to control CFCs before the international agreements outlined in the Protocol (Worrest, 2011).

In response to these policy and regulatory developments, industrial organizations directly affected have been actively engaged in developing alternative substances to CFCs and other ozone-depleting compounds. Several environmental and economic factors need to be considered in the Chlorofluorocarbon Phase, such as safety characteristics, efficiency, ozone-depletion potential, and economic impacts on the industry of phase-out schedules for existing CFCs (Worrest, 2011).

## FORMATION OF OZONE LAYER

The ozone layer is a part of the Earth's atmosphere. The Earth's atmosphere is composed of three regions: the troposphere, which extends up to about ten kilometres from the Earth's surface; the stratosphere, which is found approximately ten and fifty kilometres from the Earth's surface; and ionosphere, which extends up to 350 kilometres from Earth (UNEP, a). The ozone layer is in the lower part of the stratosphere and in the troposphere, also known as surface-level ozone (UNEP, a). The distribution of ozone in the stratosphere is a function of altitude, latitude and season (Ward, 2023). Photochemical mechanisms and transport processes are the processes through which the ozone layer is formed (Worrest, 2011). Ozone is also formed by the ultraviolet light striking the oxygen. Oxygen molecules become single and then again react with unbroken oxygen and form ozone (UNEP, b). Ozone is a colourless gas. Chemically, it is very active and it reacts readily with a great many other substances. Near the Earth's surface, those reactions cause rubber to crack, hurt plant life, and damage people's lungs and tissues (UNEP, b).

The ozone layer protects the earth from the harmful ultraviolet rays of the sun, known as ultraviolet rays (UV-A and UV-B). High above the surface, above even the weather systems, a tenuous layer of ozone gas absorbs UV-B, protecting living things below (USEPA, 2021). Each year for the past few decades during the Southern Hemisphere spring, chemical reactions involving chlorine and bromine cause ozone in the southern polar region to be destroyed rapidly and severely. This depleted region is known as the "ozone hole" (USEPA, 2021). The area of the ozone hole is determined from a map of the total column of ozone. It is calculated from the area on the Earth that is enclosed by a line with a constant value of 220 Dobson Units (units of measure for total ozone) (Chillymanjaro, 2012).

Ozone Layer as stated earlier is naturally formed in the Stratosphere about 10km-50km above the earth's surface. This is our natural sunscreen; it absorbs UV radiation (USEPA, 2021). Although ozone high up in the stratosphere provides a shield to protect life on Earth, direct contact with ozone is harmful to both plants and animals (including humans). In the troposphere near the Earth's surface, the natural concentration of ozone is about 10 parts per billion (0.00001 %). According to the Environmental Protection Agency (EPA), exposure to ozone levels of greater than 80 parts per billion for 8 hours or longer is unhealthy. Such concentrations occur in or near cities during periods when the atmosphere is warm and stable. The harmful effects can include throat and lung irritation or aggravation of asthma or emphysema (Chillymanjaro, 2012).

## HISTORICAL BACKGROUND ON THE INTERNATIONAL RESPONSES TO THE PROBLEM OF OZONE LAYER DEPLETION

### *The Problem*

Some of the chemicals produced in the recent past, deplete the Ozone Layer by destroying its dynamic stability. The most harmful chemicals are Chlorofluorocarbons (CFCs), Halons, Methyl bromide (MeBr), Carbon tetra chloride (CTC) and Methyl chloroform (MC). These pollutants are molecules that alter the equilibrium of natural reactions of the Ozone Layer by destroying Ozone molecules at a faster rate. It has been estimated that one Chlorine free radical can destroy up to one million Ozone molecules. (Caron, 1991). The usage of Ozone Depleting Substances (ODS) appears in some of the following ways (Caron, 1991):

- CFC as a refrigerant;
- CFC as an aerosol or propellant in manufacturing Scents, perfumes, Paints, Pesticides etc.;
- CFC as a foam-blowing agent;
- MeBr as a pesticide;
- CTC and MC as cleaning agents;
- CTC is used in the quality testing process of Activated Carbon in the manufacturing industry;
- Halon as a fire protection chemical.

The lifetime of some of these ozone-depleting substances is very long, and they may continue to deplete the ozone layer long after their use has been phased out. Nevertheless, some shorter-lived substances may have a very high chlorine loading potential and thus their effect in the short term is much larger than reflected by their ODS value. Aircraft emissions of nitrogen oxides and water vapour add to these depletion effects by creating ice crystals that serve as a base for ozone-destroying reactions (USEPA, 2021).

### *Environmental and Health Impact of Ozone Depleting Substances*

There are many severe environmental and health problems due to ozone depletion. With new technology and science, it is found that there is ozone depletion causing many problems like skin cancer, burning of skin, sunstrokes, etc. These depletions can be by catalysts like nitrous oxide, nitric oxide, hydroxyl, atomic chlorine, atomic bromine and many more. Chlorofluorocarbons and bromofluorocarbons also cause the breakdown of thousands of ozone molecules which lead to the poor absorbing capacity of UV-A and UV-B rays from the sun by the ozone layer. In this way ozone layer is getting depleted day-by-day and thus people are suffering regularly. Thus, the potential consequences of this ozone depletion are (Hunter *et al.***,** 2007):

1. Increase in UV-B radiation at ground level: a one Percent loss of ozone leads to a two Percent increase in UV radiation. Continuous exposure to UV radiation affects humans, animals and plants, and can lead to skin problems (sunburns, ageing, and cancer), depression of the immune system, and corneal cataracts (an eye disease that often leads to blindness).

2. Increased UV radiation may also lead to a massive die-off of phytoplankton (a $CO_2$ sink"). Since UV rays contain a lot of energy, they can penetrate much deeper in oceans seas and freshwater bodies. Therefore, UV destroys fish eggs and amphibian eggs and larvae. Phytoplankton is the primary producer of the oceans and UV destroys them. Thereby food chains of the Oceans are affected and fish production will be reduced. Genes are UV sensitive and thereby they can cause mutations leading to cancer. UV-B penetrates much deeper, destroying Phytoplankton which absorbs $CO_2$ for photosynthesis. This indirectly increases global warming.
3. Disturbance of the thermal structure of the atmosphere, probably resulting in changes in atmospheric circulation. UV rays in the lower atmosphere produce ground-level Ozone. This highly reactive Ozone causes respiratory diseases.
4. Reduction of the ozone greenhouse effect: ozone is considered to be a greenhouse gas. A depleted ozone layer may partially dampen the greenhouse effect. Therefore, efforts to tackle ozone depletion may result in increased global warming. CFCs are powerful greenhouse gases and as such directly affect global warming. CFCs in the atmosphere lead to mean sea level rise, soil erosion, melting glaciers and polar ice caps and changes in global and local weather patterns.
5. Changes in the tropospheric ozone and the oxidizing capacity of the troposphere.
6. Materials such as wood and plastic products lose strength and colour as a result of UV-B radiation.

It is now clear that the amount of ozone present in the Earth's atmosphere has critical implications for the environment, human health and national economies. Since not one country can control ozone depletion, it is an important issue in international environmental law (USEPA, 2023). To this end, The Vienna Convention and the Montreal Protocol are considered as the most successful environmental agreements. The Vienna Convention for the Protection of the Ozone Layer was adopted on 22nd March 1985 in Vienna, Austria. The Montreal Protocol on substances that deplete the Ozone Layer was adopted on 16th September 1987 in Montreal, Canada.

### *A Brief History of the International Response to the Problem*

As already explained, a diffuse layer of ozone in the upper reaches of our atmosphere has shielded life on the planet from ultraviolet radiation for millions of years. A seemingly unrelated event in 1928 was the development of chlorofluorocarbons (CFCs) by Dupont chemists. These extremely stable and consequently long-lived substances were hailed as technological triumphs (Caron, 1991. If one recurrent theme in the effort to protect the ozone layer is uncertainty as to the reality or extent of a threat, then it is noteworthy that for almost fifty years after the discovery of CFCs, the community was ignorant of the threat CFCs posed and, as a consequence, focused only upon the benefits they bestowed. CFCs came to be used in a multitude of ways and the amount and types of CFCs utilized grew dramatically, first after World War II and again in the late 1960s (Caron, 1991).

In 1974 however, two scientists postulated that these stable substances, for the most part, ultimately reached the stratosphere; that once there, they finally became exposed to the ultraviolet radiation from which they had been shielded by the ozone layer; that this highly energetic radiation broke down the CFC molecule, releasing chlorine atoms; and that such chlorine atoms then served as catalysts in reactions which broke down ozone molecules (Caron, 1991; Okorodudu-Fubara, 1998). It was estimated that each chlorine atom released could destroy 100,000 ozone molecules, ultimately depleting the ozone layer and exposing the planet to increased harmful ultraviolet radiation. Two responses to this theory quickly emerged. Some experts pointed to the dangers of failing to act quickly to protect the ozone layer. Others pointed to the costs of acting precipitously based on a contested and yet unproven hypothesis. This confrontation became a key characteristic of the debate regarding CFCs and ozone depletion for most of the decade that followed. Moreover, because the issue became a clash of experts which was not accessible to laypeople, there was a lack of shared knowledge concerning the problem that in many ways foreclosed broader public participation (Caron, 1991).

In April 1975, the U.S National Research Council (NRC) undertook a formal study of the CFC problem and created the Committee on Impacts of Stratospheric Change, which subsequently issued two reports: *Effects on Stratospheric Ozone (1976) and Halocarbons: Environmental Effects of Chlorofluoromethane Release (1976)* these reports predicted that stratospheric Ozone reduction would reach 6 to 7.5 Percent eventually, if the 1973 release of CFCs were maintained, and the latter report (page 3) concluded " In our present state of knowledge, it would be imprudent to accept increasing chlorofluoromethane (CFM) use and release, either in the United States or worldwide" (Okorodudu-Fubara, 1998). In response to these and other studies and to the growing concern about the long-term effects of continued CFM release, in 1978, the United States initiated steps to ban the nonessential use of CFMs as aerosol spray propellants, the ban went into final effect in April 1979, by which time compliance was complete. However, only a few other nations took comparable steps; and concern remained that, after a temporary drop, global CFC emissions would again begin to increase (Okorodudu-Fubara, 1998).

In the Clean Air Act Amendments of 1977 (Public Law 95096), Congress directed the Environmental Protection Agency “to contract with the National Academy of Sciences to study the state of knowledge and the adequacy of research efforts to understand:

a. The effects of all substances, practices, processes, and activities which may affect the stratosphere;
b. The health and welfare effects of modifications of the stratosphere, especially ozone in the stratosphere; and
c. Methods of control of such substances, practices and activities including alternatives, costs, feasibility, and timing.”

The first two of these tasks were assigned to the existing Committee on Impacts of Stratospheric Change (CISC) (Okorodudu-Fubara, 1998). In response to the new charge, CISC, assisted by three subsidiary panels, addressed (I) stratospheric chemistry and transport, (II) effects on climate, and (III) effects on health, and produced late in 1977 the report: *Response to the Ozone Protection Sections of the Clean Air Act Amendments of 1977: An Interim Report.* The 1977 CISC report generally confirmed the earlier CISC results, although the estimated stratospheric ozone reduction resulting from continued CFM emissions was roughly double the earlier figure because of improved information on the rate constants for several key reactions. Nevertheless, the new estimate lay within the uncertainty limits of the previous report. In addition, recognition of the strong coupling between the ozone-destructive reactions involving oxides of chlorine and those involving oxides of nitrogen (which make the expected effects of either containment depend on the amount of the other) markedly reduced the expected effect of nitrogen oxides – emitted in the exhausts of high-flying aircraft and by natural degradation of nitrogen fertilizers – is probably now quite small and not of immediate concern (Okorodudu-Fubara, 1998).

In 1978, CISC aided by the creation of a fourth panel on biological effects, began a new and more thorough series of studies the results of which are described in Part II of their report. The third task, listed as (C) in Public Law 95-96, involved economic, industrial, and social considerations and was deemed to be beyond the scope and expertise of CISC as it was constituted. To address this aspect, a new committee was created. The Committee on Alternatives for the Reduction of Chlorofluorocarbons Emissions (CARCE) began its work in February 1979, assisted by two subsidiary panels – one addressing industrial technology and one concerned with socio-economic impacts. CARCE's charge was to "examine the costs, feasibility, and timing of various methods of controlling human sources of stratospheric ozone depletion with primary attention to CFM and other substances that have effects of similar magnitude." It was also to consider technological methods, including emission controls, recovery and recycling, substitution of different materials, and development of new technology. It was to assess the costs of implementing these strategies, their likely effectiveness in reducing the extent of ozone depletion, their overall economic impact, and side impacts on world health and safety and the environment control measures would ultimately be needed. Because much of the economic and industrial information needed for this study did not exist, EPA sponsored, in parallel with CARCE and CISC studies, several major research efforts aimed at assembling and analyzing data on the economic and technological feasibility of controls on CFC emissions and benefits likely to accrue therefrom. Progress reports from these undertakings have been made available to CARCE and its panels (Okorodudu-Fubara, 1998).

## LEGAL REGIMES ON THE PROTECTION OF THE OZONE LAYER

International relations scholars have developed the concept of international regimes to capture the diversity and complexity of the cooperative arrangements that states use to address transborder issues of mutual concern. The canonical (if sometimes criticized) definition of regimes is "sets of implicit or explicit principles, norms, rules, and decision-making procedures around which actors' expectations converge in a given area of international relations." So defined, regimes have been described as coextensive with particular intergovernmental organizations or international agreements. But in fact, regimes are broader than specific organizations or treaties, reflecting the fact that states (and, increasingly, nonstate actors) can cooperate without creating formal institutions or legally binding commitments (Keohane, 1984).

Increased evidence of ozone depletion coupled with a growing awareness and fuller understanding of the problems prompted action at national, bilateral, regional and eventually international levels. The United States, one of the early prime movers of an eventual international agreement in this regard, had banned CFCs in aerosols as early as 1977 thus spurring a flurry of activities in industry for the development of alternative technologies. Initially, the call for international control measures on ozone-depleting substances, principally CFCs and halons, faced resistance by some countries. The United States, Japan and the European Economic Community (EEC) control 95 Percent of the World's CFC production and 85 Percent of its consumption. Many developing countries were concerned over 'set back' on the pace of their current economic development which a CFC or halogen ban may cause. Besides, most felt that they should not have to bear the burden of a problem they were least responsible for. This is again reminiscent of the ideological comments of some Third World leaders at the 1972 United Nations Conference on Human Environment in Stockholm. Some developed countries, on the other hand, were concerned about how to catch up with the United States which they saw at the time as having a greater advantage in terms of progress on substitute products and technology (Okorodudu-Fubara, 1998). Through the continued efforts of the prime movers, notably, the US and the UK, and the steering role of the United Nations Environment Programme, in March 1985, the Vienna Convention for the Protection of the Ozone Layer was adopted thus marking the first international consensus towards protection of the ozone layer and subsequently in 1987, the Montreal Protocol on Substances that deplete the Ozone Layer.

***The 1985 Vienna Convention for the Protection of the Ozone Layer (Vienna Convention)***

The Vienna Convention is an outflow of the efforts of the World Meteorological Organisation ("WMO") in 1975 after the WMO conducted the first international assessment of the global ozone situation. The alarming results demonstrated a need for swift response and led to the creation of a Plan of Action on the Ozone Layer, a result of the collaboration between UNEP and WMO. In 1981, UNEP initiated negotiations for a Global Framework Convention for the Protection of the Ozone Layer. Thus, the Vienna Convention was adopted after a consensus was reached on 22 March 1985 (UNEP, 2020).

The overall objective of the Vienna Convention is to protect human health and the environment against the effects of ozone depletion. As a framework convention, it does not establish any specific control on ozone-depleting substances. Instead, it establishes a general obligation upon parties to protect the ozone layer (Article 2) and emphasizes the need for international cooperation. It requires parties to take "appropriate measures" against the adverse effects of man-made ozone-depleting substances. These measures include the adoption of legislative and administrative measures, cooperation on research and scientific assessment, information exchange and development and transfer of technology (UNEP, 2020).

The convention provides for the creation of a Conference of the Parties ("COP"), meeting at regular intervals, and a Secretariat. The COP reviews the implementation of the Convention and establishes the necessary programmes and policies. It is the body that amends the

Convention and adopts new protocols and annexes. The Secretariat organizes and services meetings prepares and transmits reports on countries and their implementation measures and ensures coordination with other relevant international bodies. The Convention does not impose many concrete obligations nor does it enumerate any substances that these measures might relate to. Rather, it establishes a framework that needs to be filled in through further action. However, it was the Convention that acknowledged the need for preventive action before firm proof of the actual harmfulness of ozone-depleting substances was established. Thus, it remains an important indication of the emergence of the precautionary principle in the approach (UNEP, 2020).

In light of the necessity for more concrete action under the Vienna Convention, countries reconvened in Montreal in 1987 to adopt a protocol regarding the phase-out of ozone-depleting substances ("Montreal Protocol").

***The 1987 Montreal Protocol on Substances that Deplete the Ozone Layer ("Montreal Protocol")***

The Montreal Protocol is a significant milestone in international environmental law. It establishes firm targets for reducing and eventually eliminating the consumption and production of a range of ozone-depleting substances (UNEP, 2020). These substances are enumerated in Annexes A-E to the protocol and are to be phased out within the schedule given in Articles 2A-2I. The list is to be reduced periodically because the potentials of the ozone-depleting substances mentioned in the Annex were estimated based on existing knowledge as of then.

The main objective of the Montreal Protocol as amended by the 1990 London Conference is to cap and phase out within a set time frame the consumption and production of listed controlled substances which deplete the ozone layer. A restriction schedule is established to ensure the gradual phase-out of the production, consumption, import and export of ozone layer-depleting substances (Okorodudu-Fubara, 1998; UNEP, 2020). Production or consumption of CFCs is to freeze at 1986 levels, though there is room for an allowance of a 10 Percent increase beyond the level of production in 1986 only to meet the domestic needs of developing countries which fall within Article 5 of the Protocol. Consumption of halons, on the other hand, is to freeze at 1992 levels, thus giving room for the development of substitutes. There is a general undertaking to terminate the use of CFCs, specific halons and carbon tetrachloride before January 1, 2000, and the use of trichloroethylene before January 1, 2005. A Council Recommendation on Environmental Assessment and Development Assistance Projects and Programmes (CRECD) Conference in February 1992 called for a much earlier termination of CFCs and halons by the end of 1995 based on increased concern over environmental damage generated by these substances (Okorodudu-Fubara, 1998).

The Montreal Protocol includes special provisions for the needs of developing countries. It takes into account that developing countries have hardly contributed to ozone depletion and thus provides for a ten-year delay for developing countries from the time the protocol became effective for any such country (but not later than January 1, 1999) to comply with the control measures established by the Protocol (Okorodudu-Fubara, 1998). This exemption is granted under Article 5 of the Protocol, which applies to developing countries and countries whose annual calculated level of consumption of the controlled substances in Annex A is less than

0.3 kilogrammes per capita on the date of the entry into force of the Montreal Protocol or anytime until January 1, 1999. Furthermore, new financial and technical incentives were adopted to encourage developing countries to switch as quickly as possible to alternative substances and technologies (Okorodudu-Fubara, 1998).

The Protocol further attempts to address the problem of trade with countries that are not yet parties to the agreement ("non-parties"). It bans trade in controlled substances with non-parties unless they are found by the Meeting of the Parties ("MOP") to comply with the Protocol's agreements. Furthermore, the parties must discourage the export of CFC production technology. Even though the Montreal Protocol bans the export and import of ozone-depleting substances, it remains compatible with the General Agreement on Tariffs and Trade ("GATT"). Article XX (b and g) of GATT allows trade restrictions in support of environmental goals and health measures as long as they are not disguised restrictions to trade or applied in a discriminative manner (UNEP, 2020). China and India both suspected principal targets of the trade ban at the time, and previously upcoming strong consumer economies, are now parties to the Protocol. The trade ban and other international diplomacy succeeded in enlisting more and more country participation in the Convention and Protocol for the protection of the ozone layer (Okorodudu-Fubara, 1998).

One of the weaknesses of the Protocol is the absence of an effective enforcement procedure apart from the fact that some of the provisions/obligations which go to the root of the Protocol and are crucial to the success of its main objective are not legally binding. This tends to make the Montreal Protocol seem like an international gentleman's agreement. However, the 1990 Amendment to the Montreal Protocol, Annex III concerning "Non-Compliance Procedure" which became effective on January 1, 1992, established an Implementation Committee for peaceful resolution of non-compliance complaints, a procedure now becoming popular in many international environmental agreements.

The Montreal Protocol also has a formal Non-Compliance Procedure introduced by the Copenhagen Amendment (UNEP, 2020). The efficacy of the Non-Compliance Procedure is yet to be put to test; given the looming complaints by some developing countries that developed countries are not living up to their commitments under the Protocol as a result of the refusal of companies in the industrialized countries to sell substitute products/technology at fair and affordable prices.

## OTHER FRAMEWORKS

### *Meeting of Parties (MOP)*

To ensure effective implementation, the Montreal Protocol established the MOP. It is the organ that adopts amendments to the Protocol, makes adjustments in time schedules and additions to or removal from any Annex of substances and keeps the Protocol's implementation under continuous review. The MOP must consider and undertake any additional action that may be required for the achievement of the purposes of this protocol. To further secure the flexibility of the Protocol in relation to ongoing scientific research decisions, the MOP may make further adjustments to the time schedule or evaluation of ozone-depleting substances (UNEP, 2020).

### *The Multilateral Fund, its Executive Committee and Secretariat*

A Multilateral Fund was established by a decision of the Second MOP to the Montreal Protocol in June 1990 and began its operation in 1991. It aims to promote technology transfer and technical cooperation. Due to this regime (Article 10), developing countries should no longer need to rely on the ten-year delay for the phase-out of greenhouse gases provided for in Article 5 and thus can comply with the Protocol's provisions at an earlier stage. The Multilateral Fund is financed by non-article 5 parties which are mainly industrialized countries. Thus, the Montreal Protocol can be seen as viable to effectively implement the concept of common but differentiated responsibilities (UNEP 2020).

## National Implementations

### *Canada*

As one of the early signatories to the 1987 Montreal Protocol, Canada ratified it in June 1988. The country has since made significant progress in reducing the emissions of ozone-depleting substances. Canada implemented the 1987 Montreal Protocol through strong measures by federal, provincial and territorial governments, changes in technologies and voluntary actions by industry. The Ozone Depleting Substances Regulations (1998) and subsequent amendments are administered under the Canadian Environmental Protection Act (1999). These regulations control the import, manufacture, use, sale and export of Ozone Depleting Substances (ODS). It also adopted the Strategy to accelerate the Phase-Out of CFC and Halon uses and to dispose of the Surplus Stocks (Phase-Out Strategy) since May 2001. Canada has developed and implemented a National Action Plan (“NAP”) for the Environmental Control of Ozone-Depleting Substances and their Halocarbon Alternatives to ensure that a national framework for the implementation of Canada’s ozone layer protection program is realized. Furthermore, more than 95% of commercial and residential air conditioning units and more than 50% of commercial refrigeration equipment in Canada operate on hydrochlorofluorocarbons (“HCFC”) refrigerants (primarily R-22). Many commercial refrigeration units were converted to HCFCs from CFCs. It also postulated that by 1 January 2010, 65% of HCFC refrigerants currently imported into and manufactured in Canada on an annual basis will be eliminated from the supply chain and no HCFC-22 (“R-22”) equipment will be manufactured in or imported into Canada (ECCC, 2017; ECCC, 2020).

In recent times, the Ozone-depleting Substances and Halocarbon Alternatives Regulations (ODSHAR) implements Canada's obligations under the *Montreal Protocol on Substances that Deplete the Ozone Layer* (Montreal Protocol), including the Kigali Amendment. On December 29, 2016, the Ozone-depleting Substances Regulations, 1998 were superseded by the ODSHAR (ECCC, 2023**).** Controlling Ozone Depleting Substances (ODS) and imposing Hydrofluorocarbon (HFC) Restrictions are the two main functions of the ODSHAR. By gradually lowering the amount of HFCs that are imported into Canada and lowering consumer demand for HFC-containing manufactured goods, ODSHAR can carry out the phasedown of HFCs. As a result, the phasedown of HFCs will prevent further releases of HFCs into the environment and support Canada's efforts to tackle climate change (ECCC, 2023**).**

Environment and Climate Change Canada is responsible for overseeing the ODSHAR, which was created in accordance with the Canadian Environmental Protection Act, 1999 (CEPA).

### *South Africa*

South Africa signed the Montreal Protocol in 1990, the 1990 London Amendment in 1992 and the Copenhagen Amendments in 2001. To date, it has phased out CFCs, halons, methyl chloroform and carbon tetrachloride, the only developing country in the world that has achieved much and is in line with the phase-out schedule (South African Government, 2023). Though South Africa is classified as a developing country, its consumption of these substances is dual to some of the developed countries. For this reason, South Africa did not hesitate to comply with the requirements of the Montreal Protocol (South African Government, 2023). The following control measures constitute the overall position of South Africa on the Montreal Protocol:

a. Working Groups were constituted under a neutral chairmanship to assist the government in implementing the Montreal Protocol;
b. Regulated ODSs can only be imported or exported after having obtained an import/export permit through the Department of Trade and Industry under their Import and Export Control Act, Act 45 of 1963;
c. As a disincentive for the use of regulated ODSs, they could only be imported after an environmental levy of R5, 00 per kg of CFC, was paid;
d. Dissemination of information to interested and affected parties is managed and controlled; and Contributions to Africa Networking Meetings, as arranged by UNEP, towards improvement and cooperation within the region, were established.

South Africa's National Committee on Ozone Layer Protection ("NCOLP") was created to advise the Department of Environmental Affairs and Tourism on matters relating to national responsibilities concerning ozone layer protection, including monitoring and verification processes or issues of implementation and adherence to the Vienna Convention and the 1987 Montreal Protocol and its Amendments, of which South Africa is a signatory. Its purpose is also to promote education, training and awareness of ozone layer protection issues (South African Government, 2023).

### *The Nigerian Experience*

Nigeria's interest in the subject of the ozone layer dates back to 1978 when the United States Government through the EPA first informed the Nigerian Government that some industries were importing CFCs and other chemicals that had been banned in the US, under the mandatory notification procedure under Section 12 (b) of the Toxic Substances Control Act. Several regulatory agencies have also been established at the state and federal levels to combat the environmental problems that afflict our nation. In respect of ozone layer protection, The Federal Environmental Protection Agency Decree, 1988, The National Environmental (Ozone Layer Protection) Regulation, 2009. In addition, Nigeria is a signatory to several International Conventions, Protocols and Agreements aimed at partnering with other nations in solving environmental problems. Nigeria is a signatory to the Vienna

Convention for the Protection of the Ozone Layer (1985) and acceded to the Montreal Protocol on Substances that Deplete the Ozone Layer on October 31, 1988, and it became effective for the country on January 29, 1989.

In September 2012, the Federal Ministry of Environment held an HCFC Phase-out Management Plan (HPMP) Implementation Status review meeting with manufacturers of foam, and refrigeration/air conditioning systems in the country to remind them of the Federal Government's resolve to follow through with the HCFC phase out plan. Manufacturers of foam and refrigeration/air conditioning systems in the country use chemicals known technically as Hydrochlorofluorocarbons (HCFCs) that have been classified as Ozone ozone-depleting substances (ODS). These HCFCs were introduced and are widely used as transitional replacements for another ODS known as chlorofluorocarbon (CFCs) that have been phased out in developing countries (This Day Live, 2012). There are also efforts by the Federal Ministry of Environment to phase out the use of trichloroethane, and methyl bromide substances by 2015 as part of efforts to protect the ozone layer. According to the then Deputy Director of Pollution and Environmental Health, in the ministry and also a National Ozone Officer, Mr Kashimu Bayero, the ministry had set the target for banning the use of the substances in line with the deadline set by the Montreal Protocol to phase out ozone-depleting substances in developing countries. He said the ministry's ODS phase-out activities included the installation of Ozone-friendly equipment or retrofitting old ODS-based equipment to ozone-friendly ones in the affected sectors. According to him, this is to ensure that ODS are no longer used by refrigeration, manufacturing and servicing industries. Nigeria met the deadline set for phasing out Chlorofluorocarbons in 2010. Nigeria no longer imports CFCs for such uses, just as we have the responsibility to phase out the use of these substances; the developed countries that manufacture these products also have their measures within the protocol. According to Bayero, the phasing out activities had been supported by the Multilateral Fund (MLF) for the implementation of the Montreal Protocol through implementing agencies such as UNDP, UNIDO, GTZ proklima of Germany and the World Bank. (NAN) (Vanguard Online, 2013).

Nigeria has also made progress in the implementation of the Hydro-Chlorofluorocarbons (HCFCs) Phase-out Management Plan. Measures have been put in place to ensure that importers comply with the acceptable baseline consumption level in Nigeria. According to reports, the control measure covered the period between 2013 and 2015. Nigeria's consumption baseline level for 2013 freezes at the average of our 2009 and 2010 consumption. So, from 2014, it should be on the decrease. Now, the baseline amounts to 5,878.88 metric tons and is calculated as (HCFC = 398.5odp tons). The first phase of the implementation of the programme began in 2011 under a wider plan referred to as the 'HCFCs Phase-out Management Plan (HPMP)' and will be completed in 2015. By 2015, the first control measure will take effect with the expected decrease of 10 Percent consumption from the baseline level (average of 2009 and 2010 consumption). According to Bayero, *"This will be achieved through our permitting and licensing system. Every year, importers apply to the National Agency for Drug Administration Commission (NAFDAC) and the National Environment Standard Regulation Agency (NESREA) for permits to bring in these chemicals.*

*A quota system has been determined by the Ministry of Environment, which is what these agencies issue for the importation of the substances into the country. So the quota allocation for HCFCs in Nigeria took effect in 2013 and is frozen at the average of 5,878.88 metric tons of HCFCs (baseline for consumption in 2009 and 2010). By 2014, the import data should not be more than this baseline and, by 2015. Nigeria should be 10 Percent less than this average. This is specified in the HCFCs Phase-out Management Plan and was based on a consumption survey from importers and users,"* (Daily Independence Online, 2014).

**Saving the Ozone Layer**

Generally, the international consensus to protect the ozone layer and phase out ozone-depleting substances finds ready support in existing international obligations of States, particularly those expressed in what can easily be regarded as the ground norm of international environmental law: the 1972 United Nations Declaration on the Human Environment (Stockholm Conference).

Now it is extremely essential to protect the ozone layer from depletion. The use of gases which may be harmful to the ozone layer should be banned. There should be the release of more new gases that will be eco-friendly and will |not harm the ozone layer which in turn may harm the whole of mankind. International targets for the reduction of ozone-depleting substances have resulted in the almost complete phasing out of CFCs, halons and carbon tetrachloride in the EU. Methyl chloroform and methyl bromide will be phased out by 2005 and this was achieved in 2015 (UNEP, c) and HCFC by 2040 (UNEP, d). But in certain countries, CFCs are not yet banned. So, it is urgently needed to stop the use of CFCs and the most harmful gas nitric oxide (UNEP, d). Present trends, however, suggest that the global release of CFCs will continue to increase unless adequate steps are taken to control emissions or curtail usage. Thus, alternatives for Ozone depleting substances should be imbibed such as Hydrofluorocarbon (HFC-134a), Hydrocarbon or Ammonia used as Ozone friendly alternatives for CFC in the refrigeration sector; CFC in foam manufacturing can be replaced by HCFC or cyclopentane; Hydrocarbon for CFC as a propellant; Ozone friendly solvents; $CO_2$, water, inert gases for firefighting equipment; Natural packing material for foam made with CFC (UNEP, d).

In conclusion, it is sad that despite the success of the Montreal Protocol in cutting the production and consumption of ozone-destroying chemicals, these chemicals have a long atmospheric lifetime and it will take several decades before their concentrations are back to pre-1980 levels. The amount of ozone-depleting gases in the Antarctic stratosphere reached a maximum around the year 2000 and is now decreasing at a rate of about 1% per year (UNEP, 2010). Over the past decade, stratospheric ozone in the Arctic and Antarctic regions as well as globally is no longer decreasing, but it has not yet started to recover either. The ozone layer outside the Polar Regions is projected to recover to its pre-1980 levels before the middle of this century. In contrast, the ozone layer over the Antarctic is expected to recover much later (UN News, 2023).

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