ANALYSIS OF THE DEPLETION OF OZONE LAYER AND ITS EFFECTS

Turyahebwa Robert
University of Lay Adventists of Kigali, Faculty of Law
Email: rturyahebwa@gmail.com

Abstract

The ozone layer is a region of Earth's stratosphere that absorbs most of the Sun's ultraviolet (UV) radiation. It contains high concentrations of ozone (O₃) relative to other parts of the atmosphere, although it is still very small relative to other gases in the stratosphere. The ozone layer contains less than ten parts per million of ozone, while the average ozone concentration in Earth's atmosphere as a whole is only about 0.3 parts per million.

The ozone layer is mainly found in the lower portion of the stratosphere, from approximately 20 to 30 kilometres (12 to 19 mi) above Earth, though the thickness varies seasonally and geographically.

The ozone layer was discovered in 1913 by the French physicists Charles Fabry and Henri Buisson. Its properties were explored in detail by the British meteorologist G. M. B. Dobson, who developed a simple spectrophotometer (the Dobson meter) that could be used to measure stratospheric ozone from the ground.

The ozone layer absorbs 97–99% of the Sun's medium-frequency ultraviolet light (from about 200 nm to 315 nm wavelength), which otherwise would potentially damage exposed life forms near the surface.

The ozone layer can be depleted by free radical catalysts, including nitric oxide (NO), nitrous oxide (N₂O), hydroxyl (OH), atomic chlorine (Cl), and atomic bromine (Br).

In terms of legal framework, the protection of the Ozone layer is governed by the Vienna Convention for the Protection of the Ozone Layer which is a Multilateral Environmental Agreement. It is one of the most successful treaties of all time, having been ratified by 197 states. Rwanda ratified the convention on the protection of the Vienna convention on 11 Oct 2001.

1. It was agreed upon at the Vienna Conference of 1985 and entered into force in 1988.
1. Introduction

The definition of Ozone layer is provided for under the 1985 Vienna Convention for the protection of the Ozone Layer. Under this Convention, the Ozone Layer "means the layer of atmospheric ozone above the planetary boundary layer"\(^2\). In the present centuries, protection of the Ozone Layer is of great concern because scientists discovered that it was developing a hole as a result of consumption and production of substances that deplete the Ozone Layer commonly known as Ozone depleting substances [herein after ODS]\(^3\). Protection of the Ozone Layer is of great concern because if not protected it will eventually diminish.\(^4\) The Ozone Layer protects the world from direct sunrays or ultraviolet radiations [UV radiations] by filtering them. These rays if not protected cause skin cancer and other related diseases\(^5\).

The great concern of the production and consumption of ODS, led to the adoption of the 1985 Vienna convention and the 1987 Montreal Protocol as they will be discussed below in detail. Although faced with uncooperative welcome by some of the states most especially developing countries that, limiting the production and consumption of ODS would hinder their industrial progress, as time went on support to the aforementioned instruments was gained due to their importance and the role they play to protect the world. The reason why there was such hesitation by developing countries was that they would not be able to afford alternative technology and lacked sufficient funds to implement the controls\(^6\).

2- Causes of Ozone Layer Depletion

A combination of several factors contributes to the depletion of the Ozone Layer. The causes of depletion of ozone layer is based on two streams, that is the natural factors such as volcanic eruptions and artificial factors such as production and consumption of chlorofluorocarbons [herein after CFCs].\(^7\).

In addition the production of substances that deplete the Ozone Layer, trade in such

\(^2\) Convention for the protection of the Ozone layer 1985, opened for signatures on 22 March 1985, article 1.

\(^3\) http://environment.nationalgeographic.com/environment/global-warming/ozone-depletion-overview/, accessed on 19/10/2015

\(^4\) Ibid


\(^7\) http://europa.eu.int/comm/environment/ozone/ozone_layer.htm.
activities accelerates the depletion of Ozone Layer. Although there are efforts to stop the production of CFCs and other chemicals, such as chlorine and bromide, such efforts are being shattered down by countries that are involved in trade of substances that deplete the Ozone Layer. During the fifteenth Meeting of the Parties to the Montreal Protocol of 10th to 14th November in Nairobi, participants were much concerned with the illegal trade in such substances and they singled out some countries that are facilitating such trade are; United States of America, South Africa, Singapore and Dubai. They added on that such trade undermines the goals of the instruments that aim at protecting the depletion of Ozone Layer and most especially the 1987 Montreal protocol.\(^8\) 

Below are the main Ozone-Depleting Substances (ODS);

Chlorofluorocarbons (CFCs): These are the most widely used ODS, accounting for over 80% of total stratospheric ozone depletion. They are use Used as coolants in refrigerators, freezers and air conditioners in buildings and cars manufactured before 1995. It is found in industrial solvents, dry-cleaning agents and hospital sterilants. They are in principle used in foam products — such as soft-foam padding (e.g. cushions and mattresses) and rigid foam (e.g. home insulation)\(^9\).

Halons; these are used in some fire extinguishers, in cases where materials and equipment would be destroyed by water or other fire extinguisher chemicals. In B.C., halons cause greater damage to the ozone layer than do CFCs from automobile air conditioners\(^10\).

Methyl Chloroform; Used mainly in industry — for vapour degreasing, some aerosols, cold cleaning, adhesives and chemical processing.

Carbon Tetrachloride: Used in solvents and some fire extinguishers.

Hydrofluorocarbons (HCFCs); HCFCs have become major, “transitional” substitutes for CFCs. They are much less harmful to stratospheric ozone than CFCs are. But HCFCs they still cause some ozone destruction and are potent greenhouse gases\(^11\).

3- International Conventions That Deal With Depletion of Ozone Layer

\(^8\) \url{http://www.ipsnews.net/interna.asp?idnews=21110}.

\(^9\) \url{http://www.bcairquality.ca/101/ozone-depletion-causes.html}

\(^10\) \textit{Ibid}

\(^11\) \textit{Ibid}
As mentioned earlier, two instruments: the 1985 Vienna convention and the 1987 Montreal Protocol are the major instruments that are referred to when protecting the ozone layer.

3.1: The 1985 Vienna Convention for the Protection of the Ozone Layer

The Vienna convention was adopted to address the ozone depleting substances and what steps should be taken to control such substances. It was adopted in 1985 and entered into force in 1988 according to its provisions\(^\text{12}\). It is the first Convention that was designed specifically to deal with ozone layer depletion.

Analysing its preamble, the Convention aims at protecting human health from adverse modifications of the ozone layer. These include cancer and other related diseases. It is a very helpful Convention as far as protecting the Ozone Layer is concerned. In the first instance, it obliges parties to the Convention to cooperate and protect human health from activities that deplete the Ozone Layer. Such cooperation is done with competent international organizations on the basis of available scientific technology\(^\text{13}\). Also the Vienna Convention encourages members to involve in research and make systematic observations, co-operation in the legal, scientific and technical fields, and lastly to cooperate and transmit information on all substances that deplete the Ozone Layer\(^\text{14}\).

The 1985 Vienna Convention is the starting point. It mostly calls for the cooperation between member parties. It also gives the definition of the ozone layer. This implies that although not setting specific measures, which should be implemented to control the depletion of Ozone Layer, it is credited for being the first Convention to address the issue\(^\text{15}\). With such lack of specified control measures, the Montreal Protocol was adopted to fill the gaps in the Convention.

3.2: The Montreal Protocol on Substances that Deplete the Ozone Layer

The second instrument that deals with the protection of the Ozone Layer is the Montreal Protocol on Substances that Deplete the Ozone Layer. The Protocol was adopted in September 1987. It has been amended two times since it came into force

\(^{12}\) 1985 Vienna Convention, Supra note 1, Article 17

\(^{13}\) Ibid, Article 2.

\(^{14}\) Ibid, Articles 2-5.

\(^{15}\) Patricia and Alan, supra note 6, p. 519.
due to changes in technology and new desires to control substances that deplete the ozone layer. The first amendment is that of the 1990 in June and another one is of 1992, which occurred in November1992\textsuperscript{16}. The Protocol has wider scope of application compared to the 1985 Convention. It aims at eliminating consumption and production of different types of substances that deplete the Ozone Layer by setting time limits for consumption and production of those substances.

According to its preamble, the Protocol supplements the Vienna Convention of 1985. Members of the Convention are also members of the Protocol. It also recognizes needs of the developing countries and requires all possible measures such as precautionary measures to be put into considerations when protecting the ozone layer\textsuperscript{17}.

The Montreal Protocol is different from the Vienna Convention in that; firstly, it sets control measures on substances that deplete the Ozone Layer. The Protocol sets limitations on the production of CFCs and Halons\textsuperscript{18}. However, in setting out those limitations, the Protocol allows some allowance in the production of substances that deplete the Ozone Layer in order to a certain degree to meet with domestic needs and protection of home industries\textsuperscript{19}.

In addition to limitations imposed on the production of substances that deplete the Ozone Layer, the Protocol has in addition set limitations to trading in such activities already produced that deplete the Ozone Layer. Such limitations include the followings; there is time schedule of trading in activities that deplete the Ozone Layer between members of the Protocol and non-members. In the first case it controls and burns trading with non parties in substances that deplete the Ozone Layer which are listed in the annex of the Protocol. Each substance was given different time depending on circumstances\textsuperscript{20}. The Protocol control burns imports in the first case from non parties and goes on to oblige members to burn even exports that contain substances that deplete the Ozone Layer to non-members. Climate change presents a growing threat to health, the environment, and national security. Emissions from ODSs and HFCs threaten to undermine efforts being taken to reduce atmospheric CO2. Consequently, there is increasing

\textsuperscript{16} Ibid.
\textsuperscript{17}The 1987 Montreal Protocol on depletion of ozone Layer, Preamble paragraph 6
\textsuperscript{18}Ibid., Article 2(a) and 2(b).
\textsuperscript{19}Patricia and Alan, supra note 6, 500
\textsuperscript{20}The 1987 Montreal Protocol, Supra note 17, Article 4
pressure for federal, international, or other climate legislation to address the threats posed by existing banks of ODSs and the growing production of HFCs.  

After limitations set for members not to import and export with non members, parties are also obliged not to engage in production and consumption of substances that deplete the Ozone Layer among themselves unless it is deemed to be essential and has been agreed upon by all party members. This shows how the Protocol sets different phases of eliminating substances that deplete the Ozone Layer.

The Protocol sets special situations for developing countries when burning substances that deplete the Ozone Layer. Developing countries are given a time of grace or a longer period to engage in production and consumption of substances that deplete the Ozone Layer. This time of grace given to the developing countries is ten years in the substances that are listed in Article 2A-2E. As earlier mentioned these special situations are given in order for the developing states to meet the basic consumption needs. However, it should be noted that, although developing countries are given such special consideration, means of improvising alternative situations are set. The Protocol has been revised in such way as to provide alternative technology so that even developing countries could stop the production of substances that deplete the Ozone Layer as soon as possible.

The Montreal Protocol also gives limit control on the consumption and production of Halons. With members of the Protocol, they were under duty to stop such consumptions of controlled substances which are in Group II of the annex A. Limitations set for the consumption of substances which are in group II of the Annex A does not exceed the year 1986 unless stated otherwise.

Apart from the CFCs and Halons, the Protocol sets limits on other substances that deplete the ozone layer such as the methyl bromide. With methyl bromide, developing countries are given special offer to consume and produce them up to 2010. It has been mentioned that most of the countries must...

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21 Patricia and Alan, supra note 6, p.520.
22 The 1987 Montreal Protocol, Supra note 17,Article 4(a)
23 Ibid, Article 5.
24 Patricia and Alan, supra note 6, 525
25 The 1987 Montreal Protocol, Supra note 17, Article 2B [1-2]
eliminate such consumption before the stated period since alternative measures has been put in place to reduce the consumption of such substances. As mentioned earlier developed states transfer alternative technology to developing countries in order to stop the consumption of substances that deplete the Ozone Layer. The time schedule for developed countries is much less, as for them the consumption of methyl was not to exceed 1995\textsuperscript{26}. However all these limitations might exceed in case there is a special need to meet domestic consumption. In addition to the above, the Protocol is much detailed and gives a wider list of other substances that equally deplete the Ozone Layer and these are; carbon tetrachloride, trichloroethane, hydrochlorofluorocarbons, hydrobromo-fluorocarbons, bromochloromethane and others\textsuperscript{27}. Such detailed list indicates the commitment under the Protocol to combat down all types of substances that deplete the Ozone Layer. It should be noted that each substance is given a different consumption date limit.

4-Obligations of Developed Countries

In order to for the stipulations set out in the Protocol to be implemented, the Protocol imposes obligations on developed states, which should be performed by them in order to stop the consumption and production of the substances that deplete the Ozone Layer. Developed countries are under duty to transfer alternative technology to developing countries. This should be done freely without any strings attached. This is very important since the required phase out schedule won’t be met if there is lack of cooperation and assistance from developed countries. The developing states on the other hand are given power to remind and demand the developed states to transfer the alternative technology in order to meet with the date limit of not using substances that deplete the Ozone Layer as set in the Protocol. This power is derived from the Protocol since it gives the developing states a right to report such uncooperative character to the party members of the Protocol\textsuperscript{28}.

5-Montreal Protocol Vis-A-Vis Trade Agreements

\textsuperscript{26} Ibid, Supra note 17, Article 2H.
\textsuperscript{27} Ibid, Articles 2(D), 2(E), 2(F), 2(G), 2(I).
\textsuperscript{28} Patricia and Alan, supra note 6, page 420.
Under the rules of WTO, members are freely to trade with each other without any restrictions. However, seeing the rules that are set in the Montreal Protocol they seem to be contradicting with rules of the most favored nation’s principle. Under the principle, products, which are the same, should be given equal treatment regardless of the country of origin. Considering the control regimes stipulated in the 1987 Montreal Protocol prohibiting importing substances that deplete the Ozone Layer from non parties of the Protocol, implies that member countries of WTO will start discriminating against non-members of the Protocol, hence violating Article 1 of the GATT. The general agreement has been that since the control of Ozone depleting substances is essential, the Protocol does not aim in strict sense to discriminate non-members but it calls for compliance of the Protocol. According to the proponents of the Protocol have argued that, the limitations set in the Protocol are in conformity with Article 20(b) of the GATT which allows members to control trade activities if that control specifically aims at protecting humans, animal and plant life of health.

What is important to note here is that control of the substances that deplete the Ozone Layer are legally accepted provided they are not done in a discriminatory manner.

6-Conclusion

As mentioned in the introduction, there is a fear that the Ozone Layer was developing a hole and this would mean not being able to filter the UV radiations, which cause cancer to the human beings. It has been discussed that several countries are signalled out for carrying out trade in activities that deplete the Ozone Layer. This should be stopped and there should be a call for implementation of strong rules that prohibits the trading of such substances that deplete the Ozone Layer.

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29 General Agreement on Tariffs and Trade (GATT) of 1994, Article 1
30 The 1987 Montreal Protocol, Supra note 17, articles 14.
31 Article 1 (1) of GATT which stipulates that (with respect to customs duties and charges of any kind imposed on or in connection with importation or exportation or imposed on the international transfer of payments for imports or exports, and with respect to the method of levying such duties and charges, and with respect to all rules and formalities in connection with importation and exportation, and with respect to all matters referred to in paragraphs 2 and 4 of Article III,* any advantage, favour, privilege or immunity granted by any contracting party to any product originating in or destined for any other country shall be accorded immediately and unconditionally to the like product originating in or destined for the territories of all other contracting parties)
32 Patricia and Alan, supra note 6, page 525.
There should be a uniform implementation of existing rules that aim at controlling the production and consumption of CFCs, Halons and other substances that deplete the Ozone Layer. As discussed before, developing countries were given a longer period to phase out the production of such activities. This sounds to be an effective control because wherever Ozone depleting substances are produced and consumed cause the depletion of Ozone Layer. It sounds as an encouragement and provides loopholes for continued production of ODS since developed countries might engage in production of ODS by setting up industries in developing countries

The Montreal Protocol, although faced with some challenges such as illegal trade in ODS; it is blessed with successes. Since its adoption in 1987 a substantial reduction of ODS is eminent. We also see that although the developing countries are given a longer period to phase out production and consumption of such substances, some developing countries are determined to stop activities that deplete the Ozone Layer before the date limit. The best example is Kenya, which has employed other means of growing flowers without using methyl bromide and has set its time limit not exceeding 2005 in use of substances that deplete the Ozone Layer\textsuperscript{34}. In addition to this, as a result of the Protocol there is now hope that by 2050 the Ozone Layer will have recovered into its original form. This shows how significant the Protocol is and why should the whole world adhere to the Protocol\textsuperscript{35}.

The two instruments: the 1985 Convention and the 1987 Montreal protocol should be given credit. The initiators of the two instruments foresaw the problem, which would have destroyed the whole world and now its time for the present generations to implement the rules stipulated in those instruments, and to adopt other rules to supplement the existing rules. This might take a long time since in some developing countries lack alternative technology and funds to employ alternative technology. However it should be noted that this should not be a problem since under the Protocol less developing countries are entitled to request the transfer of funds from developed


countries in order to eradicate the consumption and production of the substances that deplete the Ozone Layer\textsuperscript{36}.

**List of Abbreviations and Acronyms**

- **Br**: Atomic Bromine
- **CFCs**: Consumption Of Chlorofluoro-carbons
- **Cl**: Atomic Chlorine
- **GATT**: General Agreement on Tariffs and Trade
- **UNILAK**: University of Lay Adventists of Kigali
- **mi**: square miles
- **N\textsubscript{2}O**: Nitrous Oxide
- **nm**: nanometre
- **NO**: Nitric Oxide
- **O\textsubscript{3}**: Molecule of Ozone
- **ODS**: Ozone Depleting Substances
- **OH**: Hydroxyl
- **P**: Page
- **Supra Note**: Already cited
- **UVR**: Ultraviolet Radiations
- **WTO**: World Trade Organisations

\textsuperscript{36} Patricia and Alan, *supra* note 6, pp.521-523.