International Journal of Environmental and Ecology Research
www.environmentaljournal.in
Online ISSN: 2664-7117; Print ISSN: 2664-7109; Impact Factor: RJIF 5.42
Received: 02-12-2020; Accepted: 16-12-2020; Published: 02-01-2021
Volume 3; Issue 1; 2021; Page No. 04-09

Problem and prospect of ozone depletion

Ajaz Hussain[1], Shazada Ahmad[2]
[1] D/o Geography, Jamia Millia Islamia, New Delhi, India
[2] Research Scholar, D/o Geography, Jamia Millia Islamia, New Delhi, India

Abstract
The present paper attempts has been made to evaluate the "Problems of Ozono Depletion". Ozone is a form of Oxygen that is present in the earth‟s atmosphere in small amounts, while its presence in the lower atmosphere close to the earth, contributes to air pollution and causes damage to human tissues, its presence in the outer reaches of the earth‟s atmosphere is absolutely vital to life. Located 30 km above the surface of the earth, Its provide a shield against the lethal ultraviolet rays of the sun. If these rays penetrate the ozone layer life could not be possible on earth. Ozone concentration here is 10 part per million. (i.e. 10 parts of ozone per million parts of air).

Keywords: ozone depletion, earth‟s atmosphere, air pollution

Introduction

Ozone is naturally produced when high-energy radiation from the sun's rays strike the oxygen in the outer reaches of the atmosphere, converting some of its to Ozone. Electric discharge reactions, including lightning and electric spark from motor, also convert oxygen into Ozone. The chlorine contained chlorofluorocarbons (CFCs) which are used as propellant in aerosol, as refrigerant and in coolant in air conditioners, is chiefly responsible for the depletion in the ozone layer. CFCs made up of chlorine, fluorine and carbon are so chemically inert that once they are released in the atmosphere, nothings stop them till they rise to the stratosphere, and every molecules of CFC released into the air does so eventually.

The thin delicate veil containing only about one Ozone molecule in every 100,000 air molecules act as a protective sheath. The earth‟s life forms have evolved under this protective umbrella of Ozone layer which filter out harmful ultraviolet radiation. The UV radiation from the sun can attack and damage all living organisms. In human beings, high dose of UV radiation can cause Sunburn, Eye diseases, skin cancer and can suppress immune response. UV radiation also affects agricultural productivity and may damage aquatic and Terrestrials plants. The Ozone layers is, therefore, indispensible for all living organisms on the earth.

The ozone layer forms part of the earth's atmosphere. it is found in varying concentration from the Earth surface to a height of some 50 km. however, it reaches its maximum concentration between 25 to 35 km. Above the Earth surface. Ozone in the stratosphere is produced by the action of ultraviolet (UV) addition on Oxygen.

Recently, scientist all over the world have voiced a great concern as they have noticed a depletion in the Ozone layer in the atmosphere. What will be the impact of ozone depletion on human and other living organism on the earth is a matter of speculation and it can be identified easily, only after knowing the importance of the Ozone layer of the life forms on the earth surface.

Meaning of Ozone Depletion

Ozone depletion, gradual thinning of Earth‟s ozone layer in the upper atmosphere caused by the release of chemical compounds containing gaseous chlorine or bromine from industry and other human activities. The thinning is most pronounced in the Polar Regions, especially over Antarctica. Ozone depletion is a major environmental problem because it increases the amount of ultraviolet (UV) radiation that reaches Earth‟s surface, which increases the rate of skin cancer, eye cataracts, and genetic and immune system damage. (2020, Encyclopedia Britannica, Inc.)

Studies in the Antarctica have revealed a sharp decline in ozone concentration (up to 50%) during spring starting in the September and bottoming up in October. This has created a hole in the Ozone layer of the South Pole. Which in 1985 extended as far as the Southern tip of South America. The depth of the whole appears to be generally increasing. as a result of seasonal change its close in November and when the hole closes is there is average net Ozone concentration has decreased in the southern hemisphere. Areas of depletion have recently extended over Tasmania and Southern Australia recently some evidences also shown a similar Ozone hole over Antarctica.

Atmospheric Ozone

The word ozone is a derivative of the Greek word "OZEIN" which mean‟s to a small and true to its name, it has a very pungent smell but has a pleasant blue colour. Basically it is a form of Oxygen gas accepting that an oxygen molecules (O2) contains two oxygen atoms where that of Ozone (O3) contains three. Presence of this extra atoms in a molecule of ozone makes all the differences. it is present in the atmosphere in such a low portion that if all the Ozone is brought down and straight over the Earth surface, it will form only a 3 mm thick layer at the normal atmospheric pressure. Even with this diaphanous veil of ozone, the life on the earth is saved from the deadly UV radiation from the sun due to its wonderful absorbing properties. The Ozone

Concentration first decreases with altitude up to 16 km. then steadily increases upto a height of about 30 km and again decreases up to 50 km. The maximum concentration occurs between the altitude 22 to 35 km and the layer at this level is termed as "Ozone Layer". It is worth nothing that the layer is at a safe distance to avoid any direct contact with the life on the earth.

Importance of Ozone Layers

The thin delicate veil containing only about one Ozone molecule in every 100,000 molecules act as a protective sheath. The earth life forms have evolved under this protective umbrella of Ozone layer which filter out harmful UV radiation. The UV radiation from the sun can attack and damage all living things. In human beings high doses of UV radiation can cause Sun burn, Eye diseases skin cancer and can suppress same immune responses. UV radiation also affect agricultural productivity and may damage aquatic and Terrestrial plants. The Ozone Layer is, therefore, indispensable for all living thing on the earth. Reduction in fisheries would occur as a single called green algae (photoplankton) and fish larvae living near the ocean surface are destroyed by the increased exposure to UV radiation. Marine planktons constitute 75% of the marine plants mass and are the main food source for most of the marine life form as well as it is very important for the production of Oxygen. An estimate indicates that for each, one percent decreases in Ozone, some skin disease increase between 4% to 6%. This trend is of more concern for many European countries where incidence of cancer is very high. in the world as a wall Australia has the highest incident of skin cancer and outdoor way of life.

Causes of Ozone Depletion

Ozone depletion has been linked with certain synthetic Chemicals called chlorofluorocarbons (CFCs) and halogens, which react with Ozone and destroy earth‟s Ozone shield. One CFC molecules can destroy more than 100,000 Ozone molecules.

One of the most important cause of environmental pollution is due to the fossil fuel burning and industrial chemical. The widespread use of fossil fuel is increasing CO2 concentration that are affecting climatic change. In addition, the emission of nitrous and sulfurous gases into the atmosphere and their subsequent deposition is now accepted as one of the main causes of terrestrial and aquatic acidification. In extreme cases, this letter has degraded aquatic ecosystem and rendered water supply unpotable. Other contaminants, derived from

Industrial chemical, are also contributing to environmental changes via air pollution and may also be threat to human Health. For example includes CFCs that affect the Ozone layer in the stratosphere. Human activities have caused changes in the Ozone layer in the stratospheric lead (fig.1). Ozone Depletion has been linked with certain synthetic and Chemicals. CFCs and halogens are nearly colourless and virtually colourless gases and liquids that are chemically stable of low toxicity, non-flammable and had solvent and thermodynamic properties. Their useful properties have resulted in their wide use in a large range of domestic and industrial applications. These are used as aerosol propellants as cooling gases in refrigerators and air conditioning system as blowing agents in the manufacture of plastic foams and as soldex flux removal in the electronic industry. An estimate indicate that almost half the quantity of CFC are used in refrigeration and air conditioning while a third is used as a aerosol propellants. The reminder is used in the manufacturing of plastic foams and as a solvent for cleaning and decreasing. Halogens are largely used as a fire extinguisher in the aim portable device or in specialized fixed flooding system used in computer room.

Ozone Layers Nature's Perfect Balance

It is really amazing to discover how the nature has kept a perfect balance of ozone in the atmosphere to act as a filter of harmful UV radiation from the sun and to cause no harm at the sometime. The Solar radiations are not only light rays but include in their electromagnetic spectrum, ultraviolet and infrared bands also. Ordinary oxygen present in the atmosphere absorb higher energy UV rays and its each molecule get enough energy to spoil into two highly reactive oxygen atoms. These oxygen atoms, once released, combined with and unsplit oxygen molecules to form the Ozone molecule, as illustrated below. This process not only produce Ozone, it also filters out most of the incoming higher energy deadly solar UV radiations. The Ozone gas, thus formed, observes medium energy. UV rays and consequently breaks up into its constituent parts only to be formed again. Formations, breakup and Reformation of ozone thus goes on.

After many trips around this cycle, when an Ozone molecule encounters a free oxygen atom, it is converted back into ordinary oxygen. Thus along with the process of re-formation of ozone molecules, breaking up of ozone molecules into ordinary oxygen molecules also goes on. Such a cycle of formation and destruction of ozone goes on in the stratosphere, leaving a net balance of ozone gas forming the ozone layer.

The presence of other atmospheric gases, even in extremely minute quantities, Like in nitric oxide (No), chlorine (Cl), bromine (Br) and hydrogen (H2) speed up the process of disintegration of ozone into oxygen molecules without using energy from ultraviolet rays. These gases at the end of destruction cycle come back to their original form and hence are called catalyst. As an example, the atmospheric nitric oxide react with Ozone, snatches one oxygen atom and gets converted into nitrogen oxides (No2), the resulting nitrogen oxide meets free oxygen atom and quickly converted into nitric oxide. Thus it goes on converting Ozone and free oxygen atoms into oxygen and re-emerges constantly for further destruction. Similar reaction take place with the other Gases *viz.* Chlorine, bromine and hydrogen. Among such catalysts, chlorine is the biggest culprit as a single free atom of chlorine in the atmosphere can destroy 100,000 molecules of ozone before getting removed in some way. Imagine the result if one enemy soldier infiltrates into a army and kills 100,000 soldiers before it can be dealt with, which Army can survive against such few infiltrators.

The important point to be noted here is that if the ever formation and destruction process take place in an unpolluted atmosphere, the nature is able to maintain the health giving ozone layer. If excess of chlorine is released into the atmosphere, as is happening now the Ozone balance gets disturbed and this causes depletion of Ozone layer. The main source of chlorine is CFCs in the atmosphere.

The CFCs are a family of compounds of chlorine, fluorine and carbon atoms. When CFCs were first introduced in 30s they were called miracle gases because these are non-toxic, non-flammable and completely inert in the lower Ozone protected atmosphere. They are widely used as refrigerants and foaming agents in plastic

etc. They are cheap to produce and hence have found used in aerosol spray cans and solvent and cleaning fluids in electronic industry. All these applications release CFCs gases in the atmosphere from where they slowly drift upto the Ozone layer where the sun's UV traditions have enough energy to set the chlorine atoms free. Free chlorine atoms quickly start the destruction of ozone, disturbing the Ozone‟s natural talents and thus pose a threat to the Ozone layer. Apart from the CFCs there are other chlorine contain subsistence *viz*. Carbon tetrachloride, methyl chloroform and hydro-chlorofluorocarbon (HCFC22)

Which also cause the disintegration of ozone carbon tetrachloride is used as dry cleaning fluid whereas methyl chloroform is used as solvent and cleaning agent. They are also considered dangerous enough as they are released in enormous quantities (470 tons in 1985). Severe thinning of Ozone layer or its depletion, term as Ozone hole was first detected in 1984 and by 1988 there was sufficient evidence to demonstrate that the Ozone hole over Antarctica was caused by chlorine atoms derived from CFCs. Between mid-August and mid October 1987 at Halley Bay, at the altitude between 14 and 23 km. The ozone depletion was found to be 95 per cent, low enough to cause skin cancer and attacks human immune system. Only stringent controls over the production of chlorine containing hydrocarbon will repair the Ozone hole over Antarctica, the technological panel reviewing the Montreal protocol was total in Nairobi, level of chlorine had to be reduced to 2 parts per billion to close the Ozone hole. This was the conclusion of the scientist from NASA. The current level is in excess of 3 parts per billion, if the phase out of CFCs and other selected chlorinated hydrocarbons is delayed until 2000, it will take the air 2073 for the Ozone hole to close. By advancing this target just five years, the hole will close as early as 2055. It has been calculated that if the world slow down the process of phase out and the hole remain open for an additional 20 years, then major damage could be expected to the food chain in the southern oceans and fishing industry is in Australia. The NASA report recommended that the half of production and emission of long-lived halocarbons as soon as possible and suggested that this be achieved in short term by substituting short lived halo-chlorofluorocarbons CHCF(s). At a meeting held in Nairobi between August 28 and September 5, in 1989, for expert panel presented report reviewing the Montreal protocol for the United Nations Environment Programme (UNEP). The report on the scientific status of the Ozone Layer indicated that the current atmosphere at loading of chlorine is 2.7 parts per million. This should be compared to the level of ozone depleting substances which was between 1.5 to 2.0 parts per billion present over Antarctica when the hole began to appear. It was recommended that to stabilise and later reduce the chlorine loading of atmosphere, the following controls were required.

1. Hundred percent phase out of CFC by 2000 but Phase out of CFC completed in August 2008 before the mandated target of January 2010.
2. Chloro difluoro methane phase out by 2030. (It‟s a R22 a prominent family of HCFC)
3. According to the terms of the Amendment, the signing countries are expected to decrease the manufacture and usage of hydro fluoro carbons (HFCs) by about 80-85% from their baselines until 2040.

Table 1: Summary of Montreal Protocol Control Measures

Ozone Depleting Substances	Class	Developed Countries	Developing Countries
Chloro fluoro carbons	I	Phased out end of 1995[15]	Total phase out by 2010
Halons	I	Phased out end of 1993[5]	Total phase out by 2010
Carbon tetrachloride	I	Phased out end of 1995[5]	Total phase out by 2010
Methyl chloroform	I	Phased out end of 1995[5]	Total phase out by 2015
Hydro bromo fluoro carbons (HBFCs)	I	Phased out end of 1995	Phased out end of 1995
Methyl bromide	I	Freeze in 1995 at 1991 base level[16]	Freeze in 2002 at average
		25% reduction by 1999	1995–1998 base level
		50% reduction by 2001	20% reduction by 2005[17]
		70% reduction by 2000	Total phase out by 2015
Hydro chloro fluoro carbons	II	Freeze from beginning of 1996[18]	
		35% reduction by 2004	
		65% reduction by 2010	Freeze in 2016
		90% reduction by 2015	At 2015 base level
		Total phase out by 2020[19]	Total phase out by 2040

15=With the exception of a very small number of internationally agreed essential uses that are considered critical to human health and/or laboratory and analytical procedures.

16=All reductions include an exemption for pre-shipment and quarantine uses. 17=Reviewed in 2003 to decide on interim further reductions beyond 2005.

18=Based on 1989 HCFC consumption with an extra allowance (ODP weighted) equal to 2.8% of 1989 CFC consumption.

19=Up to 0.5% of base level consumption can be used until 2030 for servicing existing equipment.

Even with these controls, chlorine level in the atmosphere are expected to rise to between 4.3 and Parts per billion by. A.D. 2000 before dropping back to 2.0 parts per billion by 2060, the level at which the Antarctica Ozone hole is expected start repairing itself. A list of substances controlled by the protocol with their relative impacts on the Ozone Layer is as follows-

Table 2: Potential of Ozone Depletion and Atmosphere Life Time of CFC & HALON.

S. No.	Substance	Ozone Depletion Potential	Atmospheric Life Time
I.	CFC 11	1.0	77 Years
II.	CFC 12	1.0	139 Years
III.	CFC 113	0.8	92 Years
IV.	CFC 114	1.0	-
V.	CFC 115	0.6	-
VI.	HALON 1211	3.0	12.5 Years
VII.	HALON 1301	10.0	101.0 Years
VIII.	HCFC-22	0.04	13.3
IX.	HCFC-123	0.014	1.4
X.	HCFC-141b	0.10	9.4
XI.	H-1301	12	-

These Ozone depletion potentials are based on current state of Authors knowledge.

Montreal Protocol

The first international agreement to restrict that the atmospheric release of CFCs and other gases damaging the Ozone layer was signed in September 1987 at Montreal, term as Montreal protocol. In this agreement, eleven developed countries was ratified representing two third of the global consumption of CFCs and come into force on January 1, 1989.

The signatories to the above protocol pledge to cut down the use of CFCs in a phase Manner, that was.

1. To freeze the conjunction in 1992 at the 1986 level and then by the year 2000 bring it down to half of the 1986 consumption level.
2. To the developing countries were exempted from control over their consumption for 10 years as they lacked the technological to replace the CFCs.

In fact the international discussions which led to the signing of Montreal protocol was started in 1986, only after the Ozone hole was detected over Antarctica in 1984.

Vienna Convection

Once CFCs were recognized as the culprit for depleting Ozone layer, sensible people started camping at National and international levels, especially against the use of spray cans. These spray can use CFCs as the propellant and 75 percent of the CFC emission during 1975-76 were attributed to aerosols. This generated a heated debate as the manufacturers did not want to lose money, among scientist, manufacture ecologist, government agencies, NGOs and legal experts. Finally in March 1985, 20 Nation signed a convention for the protection of the ozone layer. The Vienna Convention established that the ozone depletion is a cause of international concern and confirmed that CFC emissions were primarily responsible, but did not specify any target or regulation concerning CFCs emissions.

Kigali Agreement and India

India is a signatory to the Kigali Agreement. India consumes only 3% of HFCs and so, it has agreed to a lenient schedule compared to other nations like the US (consumes 37%) and China (consumes 25%). According to the treaty, India should start phase down by 2028 and cut HFC emission by 15% of 2024-26 levels by the year 2047. Even though this is the easiest schedule compared to the other groups, considering India‟s ambitious,, Make in India‟ mission, even this is difficult. India had announced domestic action on HFC-23 (trifluoro-methane), a super greenhouse gas, taking into account the environmental concerns.

World Wide Consumption of CFCs

The main users of CFCs are undoubtedly the wealthy industrialized as well as urbanized countries with high life styles, rather than under the developed and developing countries. Recently, the trend is, however, showing an increase of CFCs use in the third world countries also due to changes of lifestyle. Based on 1986 data, it is clear that the consumption use of CFCs per person in Australia is greater than the rest of the world. Will. The total production of CFCs peaked in 1974 and has reduced slightly since that time. The use of CFCs in aerosol has been dramatically reduce over the last decades. However CFCs have been more popular in other applications, such as plastic form production and in dry cleaning.

Affects of Ozone Hole

Nobody would like his children or grandchildren to suffer from skin cancer and get the body's immune system attacks by ultraviolet rays. But if the facts are any indication, they are going to suffer from this horrific alignments more, unless we fulfill the promises that we all make in international fora. The unsustainable hunger of mankind to its quite natural resources has been increasing by leaps and bounds. The industrial era has not only brought in a consumption- culture as well. Ozone Layer act as an umbrella against the harmful UV radiations from the sun. According to their energy content the UV radiation could be subdivided into-

1. Ultraviolet- A, low-energy band.
2. Ultraviolet B, the media energy band.
3. Ultraviolet C, the high-energy band.

UV-A ray‟s are harmless and UV-C rays are lethal to microorganism and destroy nucleic acid and proteins and are virtually eliminated by the atmosphere in the process of formation of Ozone layer. Most of the threat to human being is from the biologically active UV-B rays. Though these rays get attenuated by ozone layer, some fraction of its does reach the earth surface. Any increase in these radiations, due to the depletion of Ozone layer, endangers the life of human beings.

Effect on immune system

What is even more worrying is that UV-B has damaging effect on human body's immune system. Therefore, vulnerability to catch all types of infection increases. It also causes cataract in the eyes. Al though to quantify, the effect would encompass all population with possible increase in the severity of infectious diseases.

Effect on skin cancer

The most worrisome biological effect due to prolonged UV-B exposure is a type of skin cancer called “Melanoma”, which is deadly if not diagnosed in early stages. It affects younger people and white skinned people.

In USA alone thousands of people die every year due to these types of cancers. According to Dr. Ninawe, Department of Biotechnology, New Delhi, people in Bombay, Delhi and

Kolkata or affected by it. More than 50,000 people are reportedly suffering in Bombay Metropolitan alone.

Retardation in Plant Growth

Higher intensities of UV-B rays retard plant growth, reduce the yield of seeds and fruits and even affect the chemical compositions of some plants, thereby changing the basic character of the plant. Their adverse effect on the growth of forest in addition to the mad deforestation being caused by the civilized world would cause climatic changes and upset the delicate natural ecological balance.

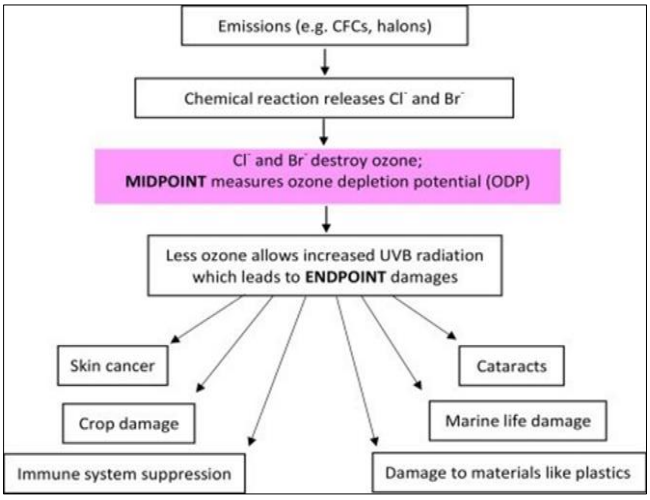

Fig 1

Effect on Marine Life

Enhance UV – B rays have reportedly been damaging aquatic organism zooplanktons, Larva Crabs/Shrimps and Juvenile fishes- which are the foods for bigger sea creatures. Therefore with such as destruction of zooplankton etc. Biggest sea creatures would starve. In many regions of the world, more than 50 percent of food protein is obtained from the Sea. Seafood, in turn, is in serious danger.

Crack in the Larsen Ice Shelf

One of the factor contributing to global warming is depletion of Ozone layer. The most notable aftermath of ozone depletion and global warming reportedly appeared during early 1995. The event was a development of 65 km long crack in the northern most part of the Larsen Ice Shelf that runs about 1000 km up the Antarctica Peninsula. The Larsen Ice Shelf is one of the several barriers that keep the vast Polar (Antarctica) Ice Cap insulated from warmer weather to prevent its melting.

During Nov. 1994, the scientists had predicted that warming climate in the Antarctica Peninsular would lead to the breakup of the northern ice shelf in 10 years, but it happened in barley two months, The Ice cap covers the continents 70 percent of the world‟s fresh water and if it melt away completely, there would be a deluge, sea levels around the worlds would rise by 40-100 metres.Scientist from many nations are closely monitoring the change in the ice shelf. Experiments have shown that average temperature in the Antarctica peninsula during the last 10 years has rise by more then 2° C and such a small increase has already cracked the Larsen Ice Cap.

No Change in Ozone Hole

According to the latest report, the Ozone hole is no bigger this year than the last year. As per levels recorded by NASA instrument abroad a Russian satellite, the Ozone hole over Antarctica has a surface area of 23 million square km, roughly the size of the North America continent. a Ozone of this size, anywhere else, would have caused skin cancer on an epidemic scale and would have also attacked the immune system of millions of people.

India has started phasing out of ozone depletion substances (ODS) atleast four years ahead of the schedule agreed upon, at the Montreal protocol in September 1992. It now plans to approach the protocol with demand of Rs.6, 000 Crores (about 2 billion dollars) for the incremental costs of phasing out such substances like CFCs.

India, with a 0.3 kg per capital consumption rate (which is the qualifying limit) qualifies for technical and financial assistance, including transfer of technologies, through the financial mechanism of the protocol. The future pace of the phase out would depend on the financial and technological assistance given by the developed member nations of the protocols. India is ahead of other members, having already started the process of phasing out of these chemicals, more so because the industry has also welcomed the exercise as the gateway to modern pollution free technology. The Government of India has created a special “Ozone Cell” headed by the Deputy Secretary, in the ministry of Environment, Forest and Climate Change to launch a ODS phasing out camping. They have offered to provide financial assistance for project to phase out ODS through new technologies or substitutes.

Control

1. At the 1987 convention in Montreal, it was decided to reduce CFCs consumption by 50 percent by 1999. It was also agreed to fridge production of specific CFCs at the 1986 level and reduce their consumption from 1993. This schedule has now been accelerated and there will be a total ban on CFCs production by 2000. India and China joined this Protocol in a two week meeting in London on June 30 1990 to review the Montreal protocol, more widely known as the Ozone Treaty.
2. India had proactively and successfully complete phase out of Hydro chloro fluoro carbon (HCFC)-141 b, which is a chemical used by foam manufacturing enterprises by 1.1.2020. Gazette of India through which the issuance of import license for HCFC-141b is prohibited from 1st January, 2020 under Ozone Depleting Substances (Regulation and Control) Amendment Rules, 2019 issued under the Environment (Protection) Act, 1986.
3. As developing countries face a formidable challenge informing their CFCs uses, as they lack the financial and technological means available to the developed nations, the developing countries have been allowed at 10 years Grace period (i.e. up to to 2010) before full compliance is required of them to the Montreal Protocol.
4. The protocol provided for a multilateral fund to assist developing countries cover their incremental cost in incremental CFCs or ODSs. India will get about 1.9 billion dollars under the protocol for using ODS substitutes. India for its part, has prohibited the import or export of eight

substances related to the depletion of Ozone to those countries which are not signatories to the Montreal Protocol. Trade in these commodities is permitted to the countries where are Parties to the Protocol.

5. The Paris Agreement, the amendment carries the legal force of a treaty as an international Protocol. In the amendment, the reduction of HFCs is formulated into three tracks. For group 1, countries, which are the richest countries, including the United States and European Union, the production and consumption of HFCs will be frozen by 2018, which will be reduced to about 15% of the 2012 level by 2036.
6. For group 2, countries, which include much of the rest of the world, including China, Brazil, and all of Africa, the production of HFCs will be frozen by 2024, which will be reduced to about 20% of the 2021 level by 2045.
7. For group 3, countries, which are the world's hottest countries, including India, Pakistan, Iran, Saudi Arabia, and Kuwait, the use of HFCs will be frozen by 2028, which will be reduced to about 15% of the 2025 level by 2047.

Reference

1. Peorson C, Pryor A. Environment: North and south, New-York, 1978.
2. Fisher AC. Resources and Environment Economics, London, 1984, 164-200.
3. Goudie AS. Environmental Change, Oxford, 1978, 41-50.
4. Gour R. Environment and Ecology of Early Man is North West India, Delhi, 1987.
5. Husain M. Human Geography, New Delhi, 1993, 105-115.
6. Jain RK. Environmental Impact Analysis, New York, 1977.
7. Smith VL. Applied to Natural and Environmental Resources and Management, vol.4, Washington, 1977, 1-24.
8. Tiwari VM, Tiwari RK. Depletion of Ozone Armouse, Employment News sept. New Delhi, 1995, 16-22.
9. Wuebbles DJ. In Encyclopedia of Atmospheric Sciences (Second Edition), 2015.
10. Curran MA. Life Cycle Assessment, Encyclopedia of Ecology, 2008.
11. Hofmann DJ, Müller R. Encyclopedia of Atmospheric Sciences (Second Edition), 2015.
12. John Durkee. Ph.D, PE. in Management of Industrial Cleaning Technology and Processes, 2006.
13. Andriy Redko, Ronald Di Pippo. Low-Temperature Energy Systems with Applications of Renewable Energy, 2020.
14. John Durkee. Ph.D, PE. Management of Industrial Cleaning Technology and Processes, 2006.
15. Daniel A. Vallero, Fundamentals of Air Pollution (Fourth Edition), 2008.
16. Barbara J. Finlayson-Pitts, James N. Pitts Jr., Chemistry of the Upper and Lower Atmosphere, 2000.
17. Rodriguez JM. Treatise on Geochemistry, 2007.
18. Press Information Bureau, Ministry of Environment, Forest and Climate Change (MoEFCC), 22 JAN 2020 6:06 PM by PIB Delhi.
19. Geoff Craighead CPP, BSCP, High-Rise Security and Fire Life Safety (Third Edition), 2009.
20. Niggol Seo S. in the Behavioral Economics of Climate Change, 2017.
21. Daniel A Vallero, in Fundamentals of Air Pollution (Fourth Edition), 2008.
22. Henry R. Hermann, in Dominance and Aggression in Humans and Other Animals, 2017.
23. Stephen O Andersen, Nancy J Sherman, Suely Carvalho, Marco Gonzalez, The global search and commercialization of alternatives and substitutes for ozone depleting substances, Comptes Rendus Geoscience. 2018; 350(7):410-424.
24. https://www.epa.gov/ods-phaseout/phaseout-class-i-ozone-depleting-substances
25. https://www.epa.gov/ods-phaseout/phaseout-class-ii-ozone-depleting-substances
26. https://www.esrl.noaa.gov/gmd/hats/odgi.html
27. https://ozone.unep.org/treaties/montreal-protocol/amendments/kigali-amendment-2016- amendment-montreal-protocol-agreed
28. https://enb.iisd.org/ozone/oewg34/
29. https://enb.iisd.org/ozone/resumed-oewg38-mop28/