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# Depletion of the Ozone Layer: A Result of Human Error or Natural Disaster?

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## ABSTRACT

*The high atmosphere's ozone layer gets thinned due to ozone layer depletion. This occurs when ozone molecules come into touch with chlorine and bromine atoms in the atmosphere and are broken down. Ozone molecules can be destroyed by one chlorine molecule. When exposed to intense ultraviolet radiation, some substances emit chlorine and bromine, which then helps to deplete the ozone layer. Ozone depleting substances are these substances (ODS). The most prevalent chemical that depletes the ozone layer is chlorofluorocarbons. The Montreal Protocol was developed in 1987 to prevent the use, manufacturing, and import of ozone-depleting compounds as well as to reduce their atmospheric concentration in order to safeguard the earth's ozone layer. The Ozone layer limits the amount of dangerous UV radiation that reaches the surface of the Earth. The ozone hole, a much bigger springtime decline in stratospheric ozone over Earth's Polar Regions, is another effect of ozone depletion. Every everyone should take action to save the ozone layer from being destroyed. Instead, we ought to use environmentally friendly goods. Keep air conditioners in good working order because when they break down, CFCs escape into the atmosphere. The objective of this study is to comprehend the ozone layer and the factors that contribute to its thinning. Another goal of this research is to identify the substances that are contributing to the ozone layer's deterioration. Environmental studies benefit greatly from this study. India is holding the G-20 presidency this year, and the country's environmental efforts serve as a model for other developed and poor nations alike. The same researcher has examined numerous journals on the environment, committee papers, and old laws and regulations. The researcher closed the research piece by offering his insightful advice to Indian lawmakers and national and international environmental organizations.*

**Keywords:** *Ozone layer, Chlorofluorocarbons, Ozone depleting substances, Environment, UV radiation, Ozone molecules.*

## I. INTRODUCTION

The ozone layer is a region in the earth's stratosphere that contains high concentrations of ozone and protects the earth from the harmful ultraviolet radiations of the sun. Ozone depletion

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consists of two related events observed since the late 1970s: a steady lowering of about four percent in the total amount of ozone in Earth's atmosphere, and a much larger springtime decrease in stratospheric ozone (the ozone layer) around Earth's polar regions . One layer of the stratosphere, the second layer of the Earth's atmosphere, is the ozone layer. The layer of insulating gases that clings to our planet is known as the stratosphere. A stratospheric layer called ozone (O<sub>3</sub>) has a significant impact on how humans can survive. The ozone layer is a layer in the Earth's stratosphere that comprises higher ozone concentrations and protects the Earth from excessive ultraviolet radiation produced by the Sun. The ozone layer absorbs over 97 to 99 per cent of the Sun's medium-frequency ultraviolet radiation (from around 200 nm to 315 nm wavelength), which would otherwise potentially harm exposed life near the surface. Many planetary, biological, and environmental phenomena depend on it. There are a variety of circumstances in which human actions have a substantial impact on the environment. One of these is harm to the ozone layer. Chlorofluorocarbons, carbon tetrachloride, methyl chloroform, halons, hydrochlorofluorocarbons (HCFC), hydrobromofluorocarbons (HBFC), and methyl bromide are the substances that are most harmful to the ozone layer. Each of these compounds affects the ozone layer differently depending on the chemical makeup of the component. Climate change and greenhouse gases like methane and nitrous oxide are other elements that have an impact on the ozone layer.

## **II. AN OZONE HOLE**

The main factor contributing to ozone depletion is the existence of source gases that contain chlorine (primarily CFCs and related halocarbons). These gases separate in the presence of UV radiation, producing chlorine atoms that then catalyze the destruction of ozone. Ozone depletion caused by Cl can occur in the gas phase, but it is significantly accelerated when polar stratospheric clouds are present . Because sunlight contributes to ozone depletion, spring is the worst time of year for ozone depletion in Antarctica. Although though PSCs are most prevalent during the winter, there is no light above the pole to fuel chemical reactions. Yet in the spring, when the sun is back in the sky, it gives off enough energy to power photochemical reactions and melt polar stratospheric clouds, releasing a significant amount of Chlorine-oxide that powers the hole mechanism. Around mid-December, the vortex dissipates as temperatures continue to climb until the end of spring. The PSCs are destroyed, the increased ozone depletion process stops, and the ozone hole closes as warm, ozone- and Nitric Oxide-rich air moves in from lower latitudes The lower stratosphere is where the majority of the ozone is destroyed, as opposed to the higher stratospheric, where the homogenous gas-phase processes that lead to ozone depletion are more common .

The main culprits behind ozone depletion are man-made chemicals. Throughout the past century, the ozone layer has been quickly destroyed by the pollutants and chemicals that humans have released into the atmosphere. Due to this depletion, people are more susceptible to UV-B rays, which are known to cause skin cancer and other genetic defects. As the idea of supersonic travel started to materialize in the late 1960s, scientists first raised the issue of ozone depletion. Nitric oxide (NO) molecules created at ground level have a half Life that is far too short for them to reach the stratosphere, despite the fact that scientists have known for a long time that NO may catalytically react with ozone (O<sub>3</sub>) to produce O<sub>2</sub> molecules. Nevertheless, none of the molecules created at ground level have a half Life long enough to reach the stratosphere. The idea of NO reacting with stratospheric ozone did not become a possibility until the introduction of commercial supersonic planes, which operate in the stratosphere and at an altitude far higher than normal jets. The hazard of ozone depletion posed by commercial supersonic travel was so serious that it is sometimes cited as the primary reason why the US federal government discontinued sponsorship for its development in 1971. Until 1974, when Sherwood Rowland and Mario Molina revealed that chlorofluorocarbons could be photolyzed by high energy photons in the stratosphere, concern over ozone depletion had subsided. They found that this procedure had the potential to release chlorine radicals, which would catalytically combine with O<sub>3</sub> and break down the molecule. The Rowland-Molina theory of O<sub>3</sub> depletion describes this mechanism.

### **III. CAUSES OF OZONE LAYER DEPLETION**

Ozone layer depletion is a major concern and is associated with a number of factors. The main causes responsible for the depletion of the ozone layer are listed below:

#### **a. Chlorofluorocarbons**

The primary contributor to the ozone layer's depletion are chlorofluorocarbons, or CFCs. They are given out by spray aerosols, refrigerators, air conditioners, and other appliances. UV rays cause the chlorofluorocarbon molecules in the stratosphere to disintegrate, releasing chlorine atoms in the process. With the ozone, these atoms interact and destroy it.

#### **b. Unregulated Rocket Launches**

According to studies, the ozone layer is destroyed considerably more quickly by uncontrolled rocket launches than it is by CFCs. By 2050, the ozone layer may have lost a significant amount of its thickness if this is not regulated.

#### **c. Nitrogenous Compounds**

The nitrogenous compounds such as NO<sub>2</sub>, NO, N<sub>2</sub>O are highly responsible for the depletion of the ozone layer.

#### d. Natural Causes

It has been discovered that some natural processes, such solar flares and stratospheric winds, degrade the ozone layer. Yet, it only contributes to 1-2% of the ozone layer loss. The volcanic eruptions are also responsible for the depletion of the ozone layer.

Following is the list of some main ozone-depleting substances and the sources from where they are released:

- Ozone-Depleting Substances Sources
- Chlorofluorocarbons (CFCs) Refrigerators, air-conditioners, solvents, dry-cleaning agents, etc.
- Halons Fire-extinguishers
- Carbon tetrachloride Fire extinguishers, solvents
- Methyl chloroform Adhesives, aerosols
- Hydrofluorocarbons fire extinguishers, air-conditioners, solvents

### **IV. OZONE LAYER DEPLETION'S IMPACTS**

The environment is negatively impacted by the ozone layer's loss. Let's examine the main impacts of ozone layer loss on people and the environment.

#### a. Human Health Impacts

When the ozone layer thins, people will be directly exposed to the sun's dangerous UV radiation. Humans may have severe health problems as a result, including skin conditions, cancer, sunburns, cataracts, rapid ageing, and weakened immune systems. Ozone depletion and the ozone hole have generated worldwide concern over increased cancer risks and other negative effects. The ozone layer prevents harmful wavelengths of ultraviolet (UVB) light from passing through the Earth's atmosphere. These wavelengths cause skin cancer, sunburn, permanent blindness, and cataracts .which were projected to increase dramatically as a result of thinning ozone, as well as harming plants and animals. These concerns led to the adoption of the Montreal Protocol in 1987, which bans the production of CFCs, halons, and other ozone-depleting chemicals . Currently, scientists plan to develop a new refrigerant to replace the old one.

#### b. Results for Animals

Animals that are directly exposed to UV light develop skin and eye cancer. Apart from whales many other animals such as dogs, cats, sheep and terrestrial ecosystems also suffer the negative effects of increased UV-B radiation .

#### c. Environmental Impacts

Intense UV radiation may prevent plants from growing, blooming, or performing photosynthesis. The detrimental effects of the UV light must also be endured by the woodlands.

#### d. Impact on Marine Life

The impact of UV radiation on plankton is significant. They are higher up the aquatic food chain. The species that are part of the food chain are likewise impacted if the planktons are killed.

### **V. INDIA'S G20 PRESIDENCY**

The 2023 G20 Delhi summit (Hindi: 2023 G20 दिल्ली शिखर सम्मेलन) is the upcoming eighteenth meeting of Group of Twenty (G20), a summit scheduled to take place in Pragati Maidan, New Delhi in 2023 . India's presidency began on 1 December 2022, leading up to the summit in the fourth quarter of 2023. The presidency handover ceremony was held as an intimate event, in which the G20 Presidency gavel was transferred from Indonesian President Joko Widodo to Indian Prime Minister Narendra Modi at the close of the Bali summit. Indonesia has presidency of 2022 . India will convene the G20 Leaders' Summit for the first time in 2023, as 43 Heads of Delegations- the largest ever in the G20–will participate in the final New Delhi Summit in September later this year. As a nation committed to democracy and multilateralism, India's presidency will be a significant milestone as it seeks to find practical global solutions for the benefit of all and embody the idea of "Vasudhaiva Kutumbakam," or "the world is one family."

The G20 Summit is held annually with a rotating presidency, and in 2023, India will hold the presidency. The group does not have a permanent secretariat and is supported by the previous, current, and future holders of the presidency, known as the troika. In 2023, the troika consists of Indonesia, Brazil, and India.

This summit will conclude a series of meetings throughout the year, with potential host cities for meetings from December 2022 to February 2023 including Bengaluru, Chandigarh, Chennai, Guwahati, Indore, Jodhpur, Khajuraho, Kolkata, Lucknow, Mumbai, Pune, Rann of Kutch, Surat, Thiruvananthapuram, and Udaipur.

Vasudhaiva Kutumbakam, which translates to "One Earth, One Family, One Future," is the

theme of India's G20 presidency. It is inspired from the Maha Upanishad, an old Sanskrit scripture. The theme fundamentally highlights the importance of all life—human, animal, plant, and microorganism—as well as their interdependence on Earth and across the universe. The theme also exemplifies LiFE (Lifestyle for Environment), which highlights the importance of environmentally sustainable and responsible lifestyle choices, both at the individual and national level, in creating a cleaner, greener, and bluer future.

The G20 Presidency also heralds for India the start of "Amritkaal," a 25-year period commencing from the 75th anniversary of its independence on August 15, 2022, leading up to the centenary India's G20 Priorities are as under:

a. Green Development, Climate Finance & Life

India's focus on climate change, with a particular emphasis on climate finance and technology, as well as ensuring just energy transitions for developing countries.

Introduction of the Life movement, which promotes environmentally-conscious practices and is based on India's sustainable traditions.

b. Accelerated, Inclusive & Resilient Growth

Focus on areas that have the potential to bring structural transformation, including supporting small and medium-sized enterprises in global trade, Market Research and Information Network, and Development / Strengthening of Agricultural Marketing Infrastructure, Grading and Standardisation , promoting labour rights and welfare, addressing the global skills gap, and building inclusive agricultural value chains and food systems.

c. Accelerating Progress on SDGs

Recommitment to achieving the targets set out in the 2030 Agenda for Sustainable Development, with a particular focus on addressing the impact of the COVID-19 pandemic.

d. Technological Transformation & Digital Public Infrastructure

Promotion of a human-centric approach to technology and increased knowledge-sharing in areas such as digital public infrastructure, financial inclusion, and tech-enabled development in sectors such as agriculture and education.

e. Multilateral Institutions for the 21st century

Efforts to reform multilateralism and create a more accountable, inclusive, and representative international system that is fit for addressing 21st century challenges

f. Women-led Development

Emphasis on inclusive growth and development, with a focus on women empowerment and representation in order to boost socio-economic development and the achievement of SDGs, the Self Employed Women's Association, was formed by self-employed and low wage women workers to support each other and organize to advocate for their rights .

## **VI. SUGGESTIONS**

### **1. Use products that are labelled “ozone friendly” or “toxic free”**

With the goal to create alternatives to products that are harmful to the ozone layer, it is possible to find products labelled “ozone friendly” or “toxic free” on the market. This signifies products whose composition is not harmful to the ozone layer. A diverse range of products are available today – from inhalers and printers, through balloons and satellites for measuring atmospheric greenhouse gases, to fire extinguishers that do not damage the ozone.

### **2. Lessen the use of Vehicles**

Most Vehicles are not made to be environmentally friendly. Moreover, studies have revealed that motor vehicle emissions contribute considerably to the ozone layer's depletion by emitting 52% of reactive hydrocarbons and 72% of nitrogen oxides into the atmosphere. Statistical data also reveals that 72% of all CO<sub>2</sub> emissions in the European Union, which account for over 30% of all transportation-related emissions, come from road travel. Because of this, it's critical to minimise the use of automobiles. Alternate methods of transportation include walking, biking, and public transportation. If you merely use your car to get from point A to point B, attempt to collaborate with others to reduce environmental pollution while also attaining economic success.

### **3. Don't Use ODS**

Use of ozone-depleting chemicals should be decreased. For instance, replace halon-based fire extinguishers with alternatives, avoid using CFCs in refrigerators and air conditioners, etc.

### **4. Buy regionally**

There are several advantages to purchasing locally produced goods. You mostly get fresh vegetables this way, but you also avoid eating stuff that has travelled great distances. Due to the substrate utilised to carry the product itself, nitric oxide is produced more frequently the further the product has to travel to reach you.

### **5. Make wise use of air conditioners**

Limiting the amount of time that the gadget is utilised is the main component of responsible



use. In that regard, it's crucial to avoid continuously running the air conditioners. Yet, it's also crucial to do routine maintenance on the apparatus because failures cause one of the most deadly chemicals, chlorofluorocarbons, to escape into the atmosphere.

#### **6. Nitrous oxide use ought to be prohibited**

The usage of dangerous nitrous oxide, which is harming the ozone layer, should be outlawed by the government. To reduce its usage on a personal level as well, people should be made aware of the negative consequences of nitrous oxide and the goods that release the gas.

There are other additional strategies to protect the ozone layer in addition to the ones just stated. We also caution you not to overlook the significance of speaking out in favour of the preservation of this mantle. Talk about methods you can all work together to save the Earth with your friends when you bring up this subject in one of your next chats.

### **VII. CONCLUSIONS**

Ozone layer is continuously depleting which is highly alarming situation of today. Chlorofluorocarbons are major cause of ozone depletion. These substances should be banned or we should use their alternatives so that in future we can protect ourselves from the harmful effects of UV radiation. Human eye and skin are the most exposed part of the body to these radiations. So there is high degree of incidence of blindness and skin cancer disease increasing day by day with the depletion of ozone layer so we should use sunglasses and full body clothes especially in summer when there is high intensity of sunlight so that we can protect our body from harmful UV radiations. We should also use sun block creams to our most exposed parts of body like face. We should also don't consume water from lakes as it may contain high quantity of hydrogen peroxide which is toxic to our bodies, and we should consume water for drinking from clean water sources.

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