

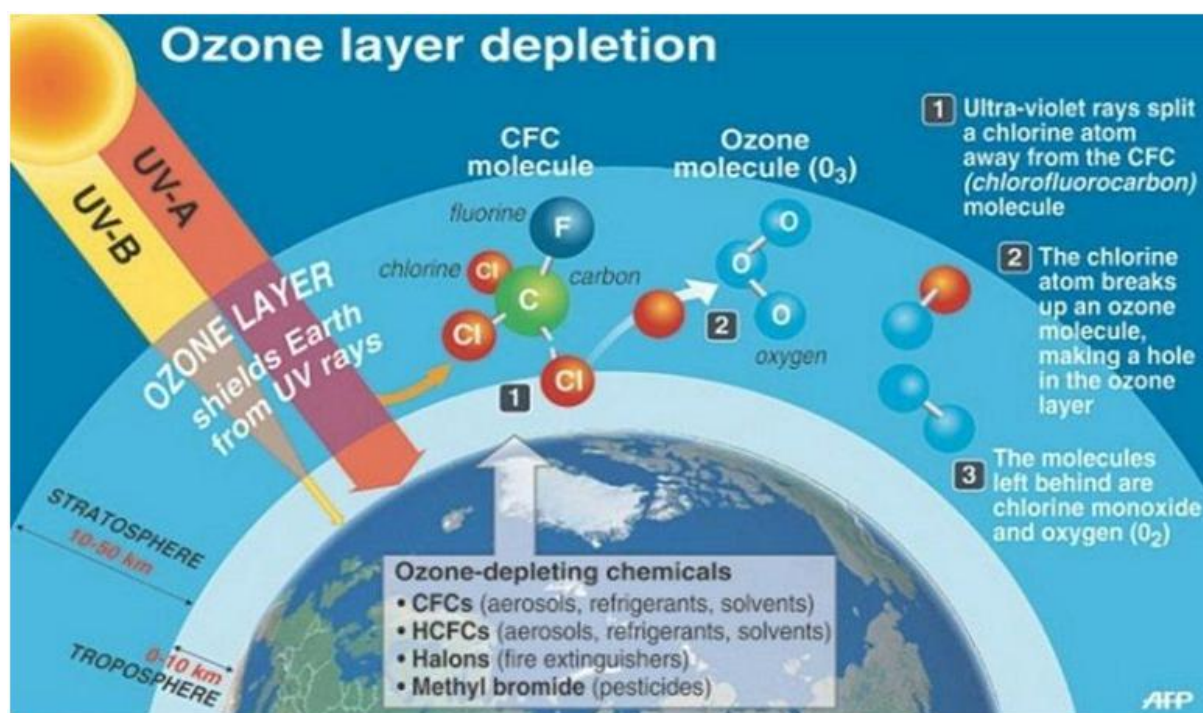
# Ozone Layer Depletion - Causes and Effects: A Review

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**Abstracts:** Atmospheric ozone protects the earth biosphere from harmful solar ultraviolet (UV) radiation. Global ozone depletion has been going on for years. It is getting worse every year. Indeed the world is taking a serious interest as the emission of chlorofluorocarbons, halons, and other destructive gases are causing ozone holes to appear in the stratospheric ozone layer. Various anthropogenic activities such as emissions of CFCs, HCFCs and other organo-halogenes lead to the depletion of ozone. Which is responsible for adverse effects on plants, human and environment with increased number of bronchial disease human. The mutation caused by UV rays result in variation in morphogenic traits of plants with ultimately decreases our productivity. UV radiation is required in optimum intensity for both plants and animals.

**Keywords:** Ozone depletion, Ultra-violet radiation, Chlorofluorocarbon, stratosphere



## 1. Introduction

Without Ozone, life on earth would not have evolved in the way it has. The ozone layer is earth's atmosphere which contains relatively high concentration of ozone (O<sub>3</sub>). This layer absorbs 93.99% of sun's high frequency ultraviolet light, which is potentially damaging to life on earth. Over 91% of the ozone in earth's atmosphere is present here. It is mainly located in a lower portion of atmosphere from approximately 10 km to 50 km 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 METROLOGIST G. M. B Dobson. Stratospheric ozone is formed naturally through the interaction of solar ultraviolet (UV) radiation with molecular oxygen (O<sub>2</sub>). As we know that plants release oxygen in the atmosphere through photosynthesis reaction. The accumulation of this oxygen led to the formation of ozone

layer in stratosphere. The process of ozone formation is called photolysis. Ozone is colourless just like oxygen but has very pungent odour. Ozone layer is really not a layer, it is a naturally gas in region called stratosphere, where ozone particles are scattered between 15 to 30km.



Ozone layer is very beneficial because it absorbs harmful ultraviolet radiations from reaching on Earth surface.

### Ozone Layer Depletion

In 1976, atmospheric research revealed that ozone layer was being depleted by chemicals released by industry mainly chlorofluorocarbons (CFCs). Concerns that increased UV radiation due to ozone depletion threatened life on earth. When ultraviolet light falls on these anthropogenic compounds like Cl and Br radicals it destroys some of the

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ozone in ozone layer and cause ozone depletion. However anthropogenic compounds reach the stratosphere and go over the tropopause. These compounds are called Chlorofluorocarbons (CFCs). They are produced in large amount and CFCs are highly stable so they reach in the stratosphere. The main ozone depleting substance are CFC-11, CFC-12, CFC-13 and halons which contain Cl and Br. In stratosphere when it is subjected to UV radiations free chlorine is produced. This free chlorine atom reacts with ozone molecule and forms ClO and oxygen molecule.



### Causes of Ozone Depletion

- 1) **Chlorofluorocarbons**-CFCs and other halogenated ozone depleting substances (ODS) are mainly responsible for man-made chemical ozone depletion. The chlorine atom act as a catalyst, and each can breakdown tens of thousands of ozone molecules before being removed from stratosphere. Chlorofluorocarbons (CFCs) are compounds composed of carbon, fluorine and chlorine. When CFCs also contain hydrogen in place of one or more chlorines, they are called Hydro chlorofluorocarbons or (HCFCs). CFCs are also called Freons. CFCs were originally developed as refrigerants during the 1930s. Some of these compound especially CFC-11, CFC-12 found use as aerosol-spray propellants, solvents and foam blowing agents. Studies indicated that CFCs are relevant into the atmosphere, accumulate in the atmosphere, where they contribute to the depletion of the ozone layer. Its lifetime in atmosphere is 20 to 100 years. It is estimated that CFCs accounts for 80 percent of ozone depletion.
- 2) **Halons**-Halons which were widely used in fire extinguishers and explosion suppression system, have an extremely high potential for ozone depletion. They are ten times more potent from CFCs and they also act as global warming agent.
- 3) **Carbon Tetrachloride (CCl<sub>4</sub>)**-Once commonly used as a cleaning agent, is an ozone-depleting chemical. It is very stable in air (lifetime 30-100 year). It can be broken down or transformed in soil and water with several days. When it breaks down, it forms chemicals that can destroy ozone in the upper atmosphere.
- 4) **Methyl Chloroforms** – Methyl chloroform is a chemical compound consisting of carbon, hydrogen and chlorine. It was popular because of its versatility and efficiency as a solvents in cleaners, degreasers and adhesives. It was widely used by the electronics and equipment manufacturing industries. Under the Montreal Protocol its use has been banned in developed countries since 1 January 1996 and developing countries have until 2015 to do the same.
- 5) **Methyl Bromide**-It can come from natural and industrial sources. It is mainly used as a fumigant. Methyl bromide damages the ozone layer once revealed into the atmosphere. It is also toxic and harmful to humans and fauna if not used carefully. Methyl bromide breaks down relatively quickly with a half-life of about seven months.

Methyl bromide may pool in poorly ventilated and low lying areas.

- 6) **Bromochloromethane**-Bromochloromethane is halon-1011. It contains carbon, chlorine and bromine and they are organic synthetic chemicals. They are found in fire protection applications, due to their effectiveness as fire extinguishing agents, however it has an ozone-depleting potential (ODP); thus, it is identified as ozone-depleting substance (ODS).

### Effect of Ozone Layer Depletion

**1) Human Health** – The ozone layer act as a natural filter, stratospheric ozone depletion leads to an increase in UV radiation that causes an adverse effect on human health that are described below-

- a) **Effect on skin**-The risk for all skin types increases with exposure of UV on human immune system have been observed in people with all skin types. There are three main types of skin cancer, basal cell carcinoma, squamous cell carcinoma and malignant melanoma. Risk of malignant melanoma has increased 10 percent.
- b) **Effect on the eyes** – Cataracts are clouding of the eyes lens and are leading cause of permanent blindness worldwide. They are result of overexposure to UV. A sustained 10 percent thinning of the ozone layer is expected to result in nearby two million new cases of cataracts per year globally. The researchers predicted that 167, 000 to 830, 000 additional cases of cataract will be reported. Snow blindness happens when UV rays damage your eyes. The surface of your eyes are sensitive to UV rays, just like your skin. This sensitivity makes you squint in bright light to protect them.
- c) **DNA and UV** – Exposure of UV damage to the DNA in various life forms. DNA absorbs the UV-B and changes in the DNA molecule mean that enzymes cannot “read” the DNA code results in muted cells or the cell die.

**2) Plants** – Ozone causes considerable damage to plants around the world including agricultural crops and plants in natural ecosystems. Ozone damages plant by entering leaf opening called stomata and oxidizing (burning) plant tissue during respiration, this damages the plant leaves and causes reduced survival. Ozone also causes a wide variety of damage in agricultural crops including visible injury, reduction in photosynthesis, alterations to carbon allocation and reduction in yield quantity and quality. High levels of ozone can inhibit a plants ability to produce chlorophyll. UV-B radiation can alter both the time of flowering as well as the number of flowers in certain species. Differences in timing of flowering may have important consequences for the availability of pollinators.

**3) Animal Health** – Increase in UV-B radiation that would result from significant losses of ozone is also potentially harmful to animals. The disease which are likely to increase if ozone depletion continues include the squamous cell carcinomas of the exposed, non-pigmented areas of cats, cattle, sheep and horses. Uberreuters syndrome in dogs is also associated with exposure to UV-B and may be expected to increase, as may the severity of conditions such as infections keratoconjunctivitis in cattle.

**4) Effect of Ozone Layer on Oceanic Life** – The effect of UV radiation on marine ecosystem is also matter of concern. Microscopic marine plants or phytoplankton, form the base food web. Dependent on sunlight for photosynthesis, phytoplankton are restricted to the upper layers of the ocean where UV-B radiation penetrates with the sunlight. Even a small decrease in phytoplankton productivity due to UV exposure could have significant effects. A decrease could be relayed through the food web and affect larvae, fish, crab, birds and mammals, which could affect the global food supply. Measurements of phytoplankton growth under increased UV concentrations due to ozone hole showed a decrease of 6 percent to 12 percent compared to normal concentrations outside the ozone hole.

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## 2. Recommendations

- 1) Avoid the consumption of gases dangerous to the ozone-layer due to their content or manufacturing process.
- 2) Minimize the use of cars – If you use a car to a destination, try to carpool with others to decrease the use of cars to pollute less and save.
- 3) Do not use cleaning products that are harmful to the environment. Many cleaning products contain solvents and substances corrosive, but you can replace these dangerous substances with non-toxic products such as vinegar and bicarbonate.
- 4) Maintain air conditioners – As their malfunctions cause CFC to escape into the atmosphere so we have to maintain our air conditioners to reduce CFC.
- 5) Buy local products – In this way you not only get fresh products but you, avoid consuming food that has travelled long distance.

And which is also good for our environment.

## 3. Conclusion

Ozone layer depletion is a deep crisis which leads to increased UV radiation affecting humans and all the living organisms. Due to anthropogenic activities large amount of ozone depleting substances are released which is the main cause for ozone depletion. We can also see wide range of adverse effect on environment.

This in order to mitigate the ozone depletion issue, we have to make sure construct their part. Protocols implanted and results are better. Whole world must join hand and spread awareness about the issue of the ozone layer depletion. Your Small efforts could make a big difference.

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