

# Ozone layer protection and impacts of ozone layer depletion

[Environment](#), [Nature](#)



## **Structure of ozone**

The ozone layer is a layer found in the Earth's stratosphere at a height of 10 km, holding a great concentration of ozone. A molecule of ozone (O<sub>3</sub>) contains three oxygen atoms which are bound together. Ozone is a gas that is highly reactive, it is naturally available in our atmosphere. (US EPA, 2018).

## **Formation of ozone**

The ozone located in Earth's atmosphere is by reactions taking place naturally involving solar ultraviolet radiation and oxygen molecules. Image credit: NOAA Earth System Research Laboratory. Image shows how ozone is formed naturally When the ultraviolet light hits these oxygen molecules, the reaction causes the molecule to break into two oxygen atoms. These single oxygen atoms which are highly reactive, each combines with an oxygen molecule to form an ozone molecule (O<sub>3</sub>). (ESRL, 2010) The ozone molecules absorb ultraviolet radiations that are between 310 to 200 nm (wavelengths), and thus they stop these harmful radiations from entering the Earth's atmosphere. (HelpSaveNature, 2018)

## **Need for the ozone layer**

The ozone layer is very beneficial for humans as it not only absorbs the ultraviolet rays from the Sun but also plays a key role in controlling the temperature structure of Earth's atmosphere. Ozone absorbs ultraviolet rays from the sun because ozone is unstable (an unstable molecule because the third oxygen atom is connected to the other two atoms with a weak bond) so the ultraviolet rays can break it up quickly which starts the formation of ozone process again. Next Ozone and Oxygen molecules absorb the UV rays

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and provide a shield that prevents this radiation from passing to the Earth's surface. The ozone layer absorbs about 98% of the ultraviolet rays emitted by the Sun. If not absorbed, UV-B would arrive in Earth's surface in concentrations that are dangerous to a range of living things. In humans, the UV-B increase the risk of skin cancer -excessive UV radiation from the sun can harm the DNA in your skin cells. If enough DNA damage builds up over time, it can cause cells to start growing out of control, which can lead to skin cancer.

Scientists believe that sunburn can change the distribution and function of disease-fighting white blood cells in humans for up to 24 hours after exposure to the sun. Repeated overexposure to UV radiation can cause even more damage to the body's immune system. Aquatic ecosystems, terrestrial plant life, single-cell organisms can be damaged by exposure of too much UV-B radiation. (ESLR, 2002) Causes of ozone layer depletion Ozone layer depletion is a very serious problem faced by our planet. Ozone depletion will lead to large amounts of ultraviolet B on Earth which is very dangerous. The reasons for the demolition of the ozone layer are a mixture of low temperatures, raised chlorine, and bromine concentrations in the upper stratosphere. (HelpSaveNature, 2018)

The leading cause of the ozone depletion is the production and emission of CFC's (chlorofluorocarbons). Chlorofluorocarbons (CFCs) are a group of odourless manufactured chemicals which are used in aerosols, refrigerators, air conditioners, foam food packaging, and fire extinguishers. When CFCs reach the stratosphere, they are exposed to ultraviolet rays, which causes

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them to break down into substances that include chlorine. The chlorine reacts with the oxygen atoms in ozone and rips apart the ozone molecule. One CFC chlorine molecule can destroy up to 100, 000 ozone molecules. (theozonehole, 2018)

Substances like Hydrochlorofluorocarbons (HCFCs), and volatile organic compounds (VOCs) that are found in vehicle emissions refrigerants, and aerosols are exposed to UV radiation in the stratosphere and thus, they break to down to release a free chlorine atom. This chlorine atom reacts with an ozone molecule, to form chlorine monoxide with a molecule of oxygen. Then, chlorine monoxide reacts with an ozone molecule making a chlorine atom, and two molecules of oxygen. These set of reactions keep taking place resulting in the depletion of the ozone layer. (HelpSaveNature, 2018)

## **Impacts of ozone layer depletion**

Depletion of the ozone layer will result in reduction of ozone in the upper atmosphere and will raise the concentration ozone in the lower atmosphere. The ozone present in the lower atmosphere is considered as a pollutant and a greenhouse gas that can contribute to climate change. It is formed when pollutants released by cars, power plants, refineries, chemical plants, and other sources react chemically in the existence of sunlight. Large concentrations of ozone in the lower atmosphere are toxic to living things. Large concentrations of bad ozone (the ozone present in the lower atmosphere) leads to problems in breathing, Aggravates lung diseases like asthma and causes harm to our lungs. (theozonehole, 2018) Ozone depletion

will result in formation of a hole in ozone layer, this would allow UV radiations to enter Earth's atmosphere.

As I mentioned in detail, earlier in my essay that UV radiations can cause skin cancer, eye damage and direct exposure to UV radiation can result in cataract and suppression of immune system. UV radiations can hamper the growth of plants and animals and can affect photosynthesis in plants.

(HelpSaveNature, 2018) International efforts made to stop ozone layer from depleting In 1987, there was an international treaty signed by 197 countries known as The Montreal Protocol on Substances that Deplete the Ozone Layer. It was made to cut out the production and consumption of ozone-depleting substances. This treaty has been a big success as the ozone layer has not grown thinner since 1998 over most of the world, and it seems to be improving because of reduced emissions of ozone-depleting substances.

The phase-out of ozone-depleting substances has also made a significant contribution towards the decrease in greenhouse gas emissions since their global warming potential is very high. It has successfully removed over 98 percent of controlled Ozone-depleting substances. (EPA, 2015) CFC's were banned in 1996 to save the ozone layer from depleting. Discussing and evaluating the implications of the use and application of science interacting with environmental factors How did the political factors affect the Montreal protocol? The USA influenced the Montreal protocol as they have an upper hand politically. All the countries agreed to the treaty because ozone layer depletion is a very important issue in the world and the governments can introduce steps to make our surroundings cleaner or saving Earth because

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they have the power and the resources to do it. Any major countries like China and USA would not want to be in such a treaty as they manufacture a lot of stuff. The ozone layer is a very important part of our atmosphere and we need to make sure that it does not deplete and we do not expose ourselves to too much UV-B radiation. Depletion of the ozone layer will also lead to global warming as tropospheric ozone is considered a greenhouse gas. (Greenhouse gases trap the Sun's heat)

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