

Ozone layer depletion: cause, effect and solution

Ozone layer is a blanket in the stratosphere composed of comparatively high concentration of ozone. Ozone (O_3) is a highly reactive gas composed of three oxygen atoms; it is both natural and manufactured product that occurs in the earth's upper and lower atmosphere i.e. the stratosphere and troposphere, respectively. Depending on where it is in the atmosphere, affects life on Earth in either good or bad ways. Stratospheric ozone is formed by natural process through the interaction of solar ultraviolet (UV) radiation with molecular oxygen (O_2). The ozone layer, approximately 20 to 30 kms above the Earth's surface, reduces the amount of harmful UV radiation reaching the Earth's surface. However, depletion of ozone layer has been reported for quite a few decades now. Ozone depletion describes two related phenomena observed since the late 1970s; a steady decline of about four percent in the total amount of ozone in Earth's stratosphere (the ozone layer), and a much larger springtime decrease in stratospheric ozone around Earth's polar regions (WMO, 2015) The latter phenomenon is referred to as the ozone hole (Fig. 1). There are also springtime polar tropospheric ozone depletion events in addition to these stratospheric phenomena. The main cause of ozone depletion and the ozone hole is man-made chemicals, especially man-made halocarbon refrigerants, solvents, propellants, and foam-blowing agents (chlorofluorocarbon (CFCs), HCFCs, halons), referred to as ozone-depleting substances (ODS). These compounds are transported into the stratosphere by the winds once emitted at the earth surface (Andino, 1999). Once in the stratosphere, they release halogen atoms through photo-dissociation, which catalyze the breakdown of ozone (O_3) into oxygen (O_2). Both types of ozone depletion were observed to increase as emissions of halocarbons increased (National Geographic, EPA). Ozone depletion and the ozone hole generated worldwide concern over increased cancer risks and other negative effects. The ozone layer prevents most harmful UVB (280 to 315 nm) wavelengths of ultraviolet light (UV light) from passing through the Earth's atmosphere. These wavelengths cause skin cancer, sunburn, and cataracts, as well as harming plants and animals. These concerns led to the adoption of the Montreal Protocol. These concerns led to the adoption of the Montreal Protocol in 1987, which bans the production of CFCs, halons, and other ozone-depleting chemicals. In 1994, the United Nations General assembly voted to designate September 16 as "World Ozone Day", to commemorate the signing of the Montreal Protocol.

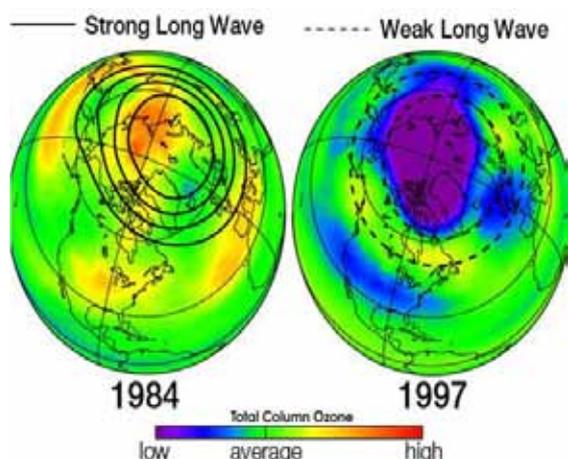


Fig. 1. Ozone hole in North America during 1984 (abnormally warm reducing ozone depletion) and 1997 (abnormally cold resulting in increased seasonal depletion).

Source: https://commons.wikimedia.org/wiki/File:Uars_ozone_waves.jpg

Depletion of ozone layer does not affect only a region or a country alone but the whole world is vulnerable to its after effects. To control and minimize the effects of ozone depletion, some solutions are given as follows: (i) Avoid products that cause ozone depletion, (ii) Do not buy aerosol products with chlorofluorocarbons; do check your fire extinguishers if halogenated hydrocarbon is the main ingredient, (iii) Dispose off old air-conditioning units, refrigerators that use chlorofluorocarbons. This could release the toxic chemicals into the atmosphere, (iv) Fertilizers and pesticides are extensively used in agriculture are a source of nitrous oxide (NO_x) production that causes depletion of ozone layer too, (v) Encourage local political representatives to raise a campaign to put forth laws governing fertilizer use, (vi) Ozone layer depletion is something that could prove hazardous for the entire human community. Speak to your friends, family members, colleagues and encourage them to drive less, eat local, to dispose off fire extinguishers and air conditioning units containing ODS (ozone depleting substances). Let us take a step further to protect our planet earth from ozone depletion.

Some Solutions:

- Replace halon-based fire extinguishers with others using foam.
- Check on the label of the products, which we buy at the supermarket, to report that they do not damage the ozone layer.
- Use your car only when necessary. The less we use our cars, the less pollutants we will emit into the atmosphere. Remember that burning fossil fuels breeds many substances that damage the ozone layer.
- Do not buy refrigerators or air conditioner equipment that use CFCs as refrigerant. Look for this information in the labels, or ask the supplier of the product directly.
- Do not use cleaning solvents containing CFCs or ammonia.
- Do not use sprays, and do not buy objects made of plastic foam (dry ice or freezer). Low consumption of these products will discourage plastic foam manufacturers.

The Ozone layer is improving since the Montreal Protocol came into effect to stop and control the use of these chemicals. The Ozone layer depends on UV-C rays from the sun to replenish its self. The contaminants from chemicals prevent it from getting what it needs to protect the earth from harmful UV-B Rays. The Ozone layer is improving, but it will need many years before the damage is repaired.

References:

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