



Government of Puducherry

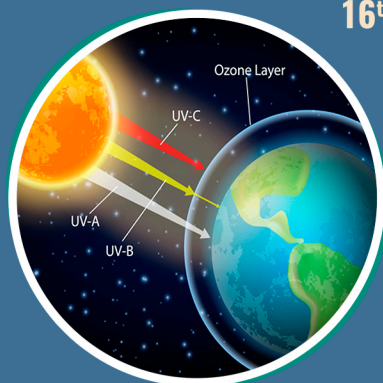
Department of Science, Technology & Environment



Puducherry Pollution Control Committee
Puducherry Council for Science & Technology
Puducherry Climate Change Cell
Puducherry Envis Hub

World Ozone Day

16th September
2021



Theme

"Montreal Protocol - Keeping us, our food and vaccines cool"

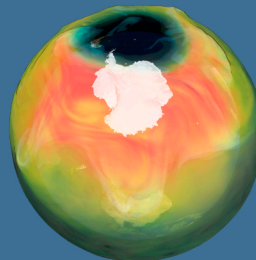
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Ozone

1. Ozone is a simple molecule of three oxygen atoms and it is present in the two lowest layers of the atmosphere - troposphere and stratosphere. The troposphere extends from the surface of the earth upto 12 km and stratosphere extends upto about 50 km from the surface of the earth. Almost ninety percent of all ozone in the atmosphere is in the stratosphere.

2. Ozone is naturally formed due to the action of sunlight with oxygen molecule. Molecular oxygen is broken down in the stratosphere by solar radiation to yield atomic oxygen, which then combines with molecular oxygen to form ozone. Ozone is also formed in the lower atmosphere due to man-made activities. In presence of sunlight it is formed due to catalytic reaction of nitrogen oxides and hy-

3. Stratosphere ozone acts as a shield thereby preventing the harmful ultra violet radiation from the sun reaching the earth. . Radiation at such wavelength is responsible for sunburn; skin cancer, cataract and can weaken the immune systems that protect us from infection. UV Radiation retards plant growth and damages the genetic structure of plants and animals.

4. Although the presence of ozone in the upper atmosphere allows life to flourish, it is a toxic gas, which is irritating to the respiratory system while present in the lower tropospheric layer. Ozone is also one of the gases responsible for increasing the temperature of the earth.

Ozone Layer

The ozone layer is the common term for the high concentration of ozone that is found in the stratosphere between 15 and 30km above the earth's surface. It covers the entire planet and protects life on earth by absorbing harmful ultraviolet-B (UV-B) radiation from the sun.

Prolonged exposure to UV-B radiation is linked to skin cancer, cataracts, genetic damage and immune system suppression in living organisms, and reduced productivity in agricultural crops and the food chain.

Montreal Protocol

1. The Montreal Protocol on Substances that Deplete the Ozone Layer (the Montreal Protocol) is an international agreement made in 1987. It was designed to stop the production and import of ozone depleting substances and reduce their concentration in the atmosphere to help protect the earth's ozone layer.

2. The Montreal Protocol sits under the Vienna Convention for the Protection of the Ozone Layer (the Vienna Convention). The Vienna Convention was adopted in 1985 following international discussion of scientific discoveries in the 1970s and 1980s highlighting the adverse effect of human activity on ozone levels in the stratosphere and the discovery of the 'ozone hole'. Its objectives are to promote cooperation on the adverse effects of human activities on the ozone layer.

3. The Montreal Protocol is widely considered as the most successful environment protection agreement. It sets out a mandatory timetable for the phase out of ozone depleting substances. This timetable has been reviewed regularly, with phase out dates accelerated in accordance with scientific understanding and technological advances

4. The Montreal Protocol sets binding progressive phase out obligations for developed and developing countries for all the major ozone depleting substances, including chlorofluorocarbons (CFCs), halons and less damaging transitional chemicals such as hydrochlorofluorocarbons (HCFCs). The Montreal Protocol targets 96 ozone depleting chemicals in thousands of applications across more than 240 industrial sectors. In 2016 the Montreal Protocol also became responsible for setting binding progressive phase down obligations for the 18 main hydrofluorocarbons (HFCs).

5. The Montreal Protocol has been further strengthened through six Amendments, which have brought forward phase out schedules and added new substances to the list of substances controlled under the Montreal Protocol. The Amendments are:

- * London 1990
- * Copenhagen 1992
- * Vienna 1995
- * Montreal 1997
- * Beijing 1999
- * Kigali 2016

6. In addition to helping to protect and restore the ozone layer, the Montreal Protocol has also produced other significant environmental benefits. Most notably, the phase out of ozone depleting substances, which are often also high global warming gases, has benefitted the global climate by reducing the amount of greenhouse gas going into the atmosphere.

Ozone Depleting Substances

Ozone depleting substances are chemicals that destroy the earth's protective ozone layer. They include:

- chlorofluorocarbons (CFCs)
- halons
- carbon tetrachloride (CCl₄)
- methyl chloroform (CH₃CCl₃)
- hydrobromofluorocarbons (HBFCs)
- hydrochlorofluorocarbons (HCFCs)
- methyl bromide (CH₃Br)
- bromochloromethane (CH₂BrCl)



The use of these chemicals is controlled by the Montreal Protocol on Substances that Deplete the Ozone Layer (the Montreal Protocol). There are other ozone depleting substances, but their ozone depleting effects are very small, so they are not controlled by the Montreal Protocol.

Where did we use ozone depleting substances?

The main uses of ozone depleting substances include:

- * CFCs and HCFCs in refrigerators and air conditioners,
- * HCFCs and halons in fire extinguishers,
- * CFCs and HCFCs in foam,
- * CFCs and HCFCs as aerosol propellants, and
- * Methyl bromide for fumigation of soil, structures and goods to be imported or exported.

Health Concerns Related to Ozone Layer Depletion

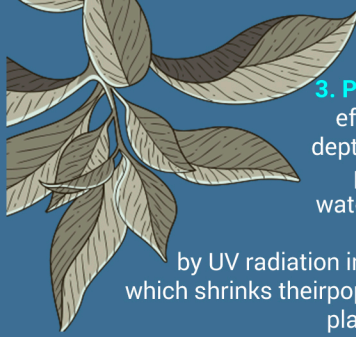
Without a stable ozone layer, humans are that much more vulnerable to ultraviolet radiation.

- 1. **Cancer and immune system** - According to the World Health Organization, ultraviolet radiation can decrease immune function and increase rates of cancer.
- 2. **Skin cancer** - 1% increase in UV radiation increases skin cancer by 2-3% according to NASA (Effects).
- 3. **Eye problems** - Over-exposure to UV radiation causes many eye problems, like cataract, and snow blindness, according to NASA (Effects).

Ecosystem Effects

Ozone depletion affects both terrestrial and marine life, because it increase the amount of UV radiation that reaches the earth.

- 1. **Lessened resistance to pests/diseases** - The EPA (Effects) notes physiological and development processes of plants can be disturbed which in turn decrease plant growth, and their resistance to pests and diseases.
- 2. **Pollination and insect effects** - NASA (Effects) reports that flowering times of plants can be affected by UV rays, which if it does not occur in synchrony with insect life-cycles affects pollination and also the insects dependent on them.



3. **Phytoplankton survival issues** - The effect on aquatic life depends on the depth at which they live. Unfortunately, phytoplanktons which live near the water surface to make use of sunlight, have been reported to be affected by UV radiation increases. Their survival is reduced which shrinks their populations note EPA (Effects). Since planktons are the basis of the marine

4. **Marine animal development hindered** - Marine animals, like fish and amphibians, also suffer because their early development processes are disrupted by UV rays, explains EPA (Effects).

5. **Less carbon capture by plants** - When plant production on land and aquatic systems is affected biogeochemical processes especially those connected to carbon production are also affected. Less plant growth means less carbon capture overall, adding to global warming notes EPA (Effects).

Climatic Effects

Climate in various parts of the world has been affected not so much by decrease in ozone as by the presence of polar ozone holes.

- **Rainfall patterns** - The presence of the ozone hole at Antarctica

What can we do about it?

There isn't much we can do about the CFCs that were released prior to the ban, but there are some things we can do:

- 1. **Old refrigerators** - If you have a refrigerator made before 1995 it probably uses refrigerant made from CFCs. Get a new refrigerator and be sure to have the old one disposed of properly.
- 2. **Air conditioning** - Old air conditioners, made before 1994, typically used a CFC called Freon. If you still have one of these, it's time to get rid of it and buy a new one. Even newer air conditioners use chemicals called HCFCs. Even though HCFCs are better for the ozone, they still contribute to the depletion, so try and use as little air conditioning as possible.
- 3. **Foam** - A lot of foam products contain CFCs. Try and use different packing materials such as crumpled old newspapers.

Ozone layer protection measures in India

The Ozone Depleting Substances (Regulation and Control) Amendment Rules, 2014, have been published by the Central Government in the Gazette of India, under Environment (Protection) Act, 1986.

Helping In Your Own Small Way

The 1985 discovery of the Antarctic hole was a wake-up call for all of us. It clearly shows that our actions can and will affect our planet. There are many small ways in which you can help.

- 1. **Remember the 3 Rs, Reduce – Reuse – Recycle.**
- 2. **If you can walk or take the train or bus, please do so. This helps cut down on pollution caused by vehicle emissions.**
- 3. **Buy energy efficient household appliances.**
- 4. **Conserve energy!**
- 5. **Use only household products that are Eco-Friendly.**
- 6. **Stop using Pesticides.**

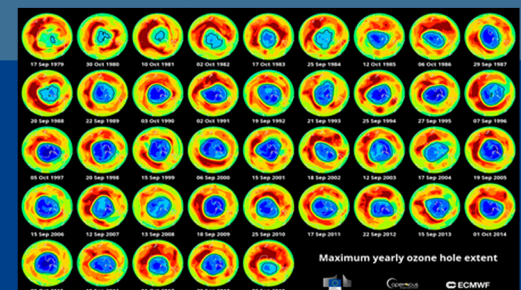
Humanity once responded to the ozone layer crisis. We don't need another crisis to take action; we can do our share now and prevent a crisis from happening again.

Actions required globally to continue the recovery of the ozone layer are:

- * Ensuring that existing restrictions on ozone-depleting substances are properly implemented and global use of ozone-depleting substances continue to be reduced.
- * Ensuring that banks of ozone-depleting substances (both in storage and contained in existing equipment) are dealt with in an environmentally-friendly manner and are replaced with climate-friendly alternatives.
- * Ensuring that permitted uses of ozone-depleting substances are not diverted to illegal uses.
- * Reducing use of ozone-depleting substances in applications that are not considered as consumption under the Montreal Protocol.
- * Ensuring that no new chemicals or technologies emerge that could pose new threats to the ozone layer (e.g. very short-lived substances).

Maximum ozone hole extent over the southern hemisphere, from 1979 to 2019.

The images below show analyses of total ozone over the Antarctic by Copernicus. The blue colours indicate the lowest ozone amounts, while yellow and red indicate higher ozone amounts



Source: European Environment Agency