Largest hole in the ozone layer heals itself: Is it Coronavirus effect?

Part of: GS-III- S&T-Ozone (PT-MAINS-PERSONALITY TEST)

Scientists believe the closing of the hole is because of the same polar vortex and not because of the lower pollution levels during the coronavirus lockdown.

Earlier this month, scientists reported a strong reduction of ozone concentrations over the Arctic believed to have been caused by unusual atmospheric conditions. The hole -- first identified in March 2020 -- is now being reported to have closed.

The Copernicus Climate Change Service (C3S) and Copernicus Atmosphere Monitoring Service (CAMS) by the European Centre for Medium-Range Weather Forecasts (ECMWF) confirmed that the largest hole in the Ozone layer above the Arctic has closed.

What is ozone layer

The ozone layer is a protective layer of gas in the stratosphere. It shields the planet from Sun’s harmful ultraviolet radiation, which can otherwise cause skin cancer and cataracts along with other environmental issues.

Scientists noticed the unusually strong depletion of ozone over the northern polar regions in March, which is believed to have been the largest hole in the Ozone layer. The hole could have led to a bigger threat had it moved towards the south.

Although mini ozone holes over the North Pole aren’t rare, the depletion over the Arctic this year was much larger compared to previous years. The reason for this year’s ozone hole is said to have occurred due to the polar vortex — a circling whirlpool of stratospheric winds responsible for bringing cold air to the polar. Scientists also believe that the closing of the hole is because of the same polar vortex and not because of the lower pollution levels during the coronavirus lockdown.

Aspire Addition

Ozone is a molecule that contains three atoms of oxygen. The ozone layer was discovered in 1913 by two French physicists Charles Fabry and Henri Buisson.

Ozone Hole - Causes and Measures to Mitigate

Earth’s atmosphere consists of several layers: Troposphere, Stratosphere, Mesosphere, Thermosphere. In the stratosphere of the Earth’s atmosphere, at a height of about 30-40kms ozone layer or ozone shield protects Earth’s surface from harmful Ultraviolet (UV) rays from the Sun. The layer contains relatively higher concentrations of ozone when compared to the other parts of the atmosphere.

At any given time, thousands of ozone molecules are created and destroyed in the atmosphere. In a way, it can be said that the UV rays have created the ozone layer since they break up Oxygen molecule into individual
recombine them into a three atom Ozone. For decades, the total amount of Ozone remained relatively stable, until the post-industrial revolution when ozone layer depletion started.

Ozone Depletion

Ozone depletion is the destruction of stratospheric ozone by free radicals like chlorine, bromine when they reach the upper atmosphere. The UV radiations break down the Chlorine molecules into Chlorine atoms. These chlorine atoms combine with Oxygen atoms broken from Ozone molecules to form ClO molecules leaving fewer amounts of Oxygen atoms to form Ozone again. This process reduces the number of Ozone molecules in the stratosphere resulting in depletion of Ozone layer.

If depletion is concentrated at one place for example at the poles, it forms a hole in the ozone layer, often referred to as Ozone hole.

Reasons for more pronounced Ozone Hole at the Poles

Ozone Hole first appeared over Antarctica because of atmospheric and chemical conditions unique to the region. However, it is wrong to say that the Arctic does not have an Ozone hole. Even the Northern Hemisphere shows Hole like phenomenon but to a lesser degree when compared to that of the Southern Hemisphere.

At Antarctica, during winter months when the region receives no sunlight, the stratosphere becomes cold enough to form high-level clouds called Polar Stratospheric Clouds (PSCs). The PSCs provide an ideal catalytic surface on which the chlorine can react with the ozone, thus destroying the ozone layer. This reaction, however, requires sunlight and therefore begins only when Sun returns to Antarctica during early spring, before the PSCs begin to melt. Hence the Ozone hole is more pronounced at the poles when compared to other regions.

Causes of Ozone Depletion

The causes for ozone depletion are free radicals like chlorine and bromine which are called Ozone Depleting Substances (ODS). ODSs are found in stable organic compounds like chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), Volatile organic compounds (VOCs), carbon tetrachloride, and methyl chloroform which are released from refrigeration, fire suppression, foam insulation, and vehicular exhaust. Natural processes like volcanic eruptions also contribute indirectly to ozone depletion by the release of aerosols.

Effects of Ozone layer Depletion

Ozone layer depletion has a number of effects on living beings and also the environment.

On living beings

The depletion of ozone layer paves the way for high energy Ultraviolet radiation to enter into the Earth's atmosphere which causes health effects on human beings like skin cancer (malignant melanoma) and cataract problems due to direct exposure to UV rays. A weakening of the immune system Acceleration of the ageing process of the skin Difficulty in breathing, chest and throat pain.

In amphibians, it affects every stage of life cycle, i.e. in the growth and development of the larvae and is said to be one of the primary reasons for declining number of amphibian species.

On environment

Ozone layer depletion leads to decrease in the ozone in the stratosphere and increase in ozone precursors.
atmosphere. Ozone in the lower atmosphere is considered to be a pollutant and a greenhouse gas as it contributes to global warming and the effect trickles down to melting polar ice caps, rising sea levels, and climate change.

Measures to mitigate Ozone depletion

Ozone depletion can be arrested by reducing the number of ozone-depleting substances in the atmosphere. This can be done by reducing the use of harmful ODSs and substituting them with other substances that do not cause ozone depletion.

The ozone layer is not something that is specific to any region or country. It hence leaves all countries vulnerable to the effects of depletion which means all the countries have to try to mitigate the effects collectively.

International efforts to reduce Ozone Depletion: Montreal Protocol

Montreal Protocol is an international treaty signed in 1987 after the Vienna Convention and came into force in 1989. According to this treaty, many countries of the world have agreed to phase out of ODSs.

Montreal Protocol is the first international treaty to have achieved universal ratification in the history of United Nations. It is also highly successful international arrangement, as it has phased out more than 95% of the ODS so far as per its main mandate (CFCs) in less than 30 years of its existence.

Currently, under the Montreal Protocol, accelerated phase-out of Hydrochlorofluorocarbons (HCFCs) is underway with the target year being 2030.

Kigali Amendment to Montreal Protocol

Kigali Amendment amends the Montreal Protocol of 1987. It aims to phase out Hydrofluorocarbons (HFCs), a family of potent greenhouse gases. Though HFCs are not ozone-depleting substances, they have been brought under Montreal Protocol as they have high global warming potential and also because Montreal Protocol has been more successful than climate change agreements like Kyoto Protocol (1997) which still do not have universal ratification and face staunch opposition from developed countries like the United States.

Under Kigali Amendment, in all 197 countries, including India have agreed to a timeline to reduce the use of HFCs by roughly 85% of their baselines by 2045.

Countries under Kigali Amendment have been divided into three groups and given different timelines to phase out of HFCs. This will be the first time that developing countries like India and China have been separately given different timelines. (China is in the second group while India is in the third group).