



# Ozone

## What is Ozone?

Ozone (composed of three atoms of oxygen) is a gas that occurs both in the Earth's upper atmosphere and at ground level. Ozone can be "good" or "bad" for your health and the environment, depending on its location in the atmosphere.

## How can Ozone be Good and Bad?

- Ozone occurs in two layers of the atmosphere. The layer closest to the Earth's surface is the troposphere. Here, **groundlevel or "bad" ozone** is an **air pollutant** that is harmful to breathe and it damages crops, trees and other vegetation.
  - It is a main ingredient of **urban smog**. The troposphere generally extends to a level about 6 miles up, where it meets the second layer, the stratosphere.
- The **stratosphere or "good" ozone layer** extends upward from about 6 to 30 miles and protects life on Earth from the sun's harmful ultraviolet (UV) rays.

## Concerns with Stratosphere Ozone Layer?

- Ozone is produced naturally in the stratosphere. But this "good" ozone is gradually being destroyed by man-made chemicals referred to as **ozone-depleting substances (ODS)**, including **chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), halons, methyl bromide, carbon tetrachloride, and methyl chloroform**.
  - These substances were formerly used and sometimes still are used in coolants, foaming agents, fire extinguishers, solvents, pesticides, and aerosol propellants.
    - Once released into the air these ozone-depleting substances degrade very slowly.
    - In fact, they can remain intact for years as they move through the troposphere until they reach the stratosphere.
    - There they are broken down by the intensity of the sun's UV rays and release chlorine and bromine molecules, which destroy the stratospheric ozone.
    - Scientists estimate that one chlorine atom can destroy 100,000 stratospheric ozone molecules.
  - Even though we have reduced or eliminated the use of many ODSs, their use in the past can still affect the protective ozone layer.
  - Research indicates that depletion of the stratospheric **ozone layer is being reduced worldwide**. Thinning of the protective ozone layer can be observed using satellite measurements, particularly over the Polar Regions.

## Depletion of Stratospheric Ozone and its Effect

- **Human health:** Ozone depletion can cause increased amounts of UV radiation to reach the Earth which can lead to more cases of skin cancer, cataracts, and impaired immune systems.
  - Overexposure to UV is believed to be contributing to the increase in melanoma, the most

fatal of all skin cancers. Since 1990, the risk of developing melanoma has more than doubled.

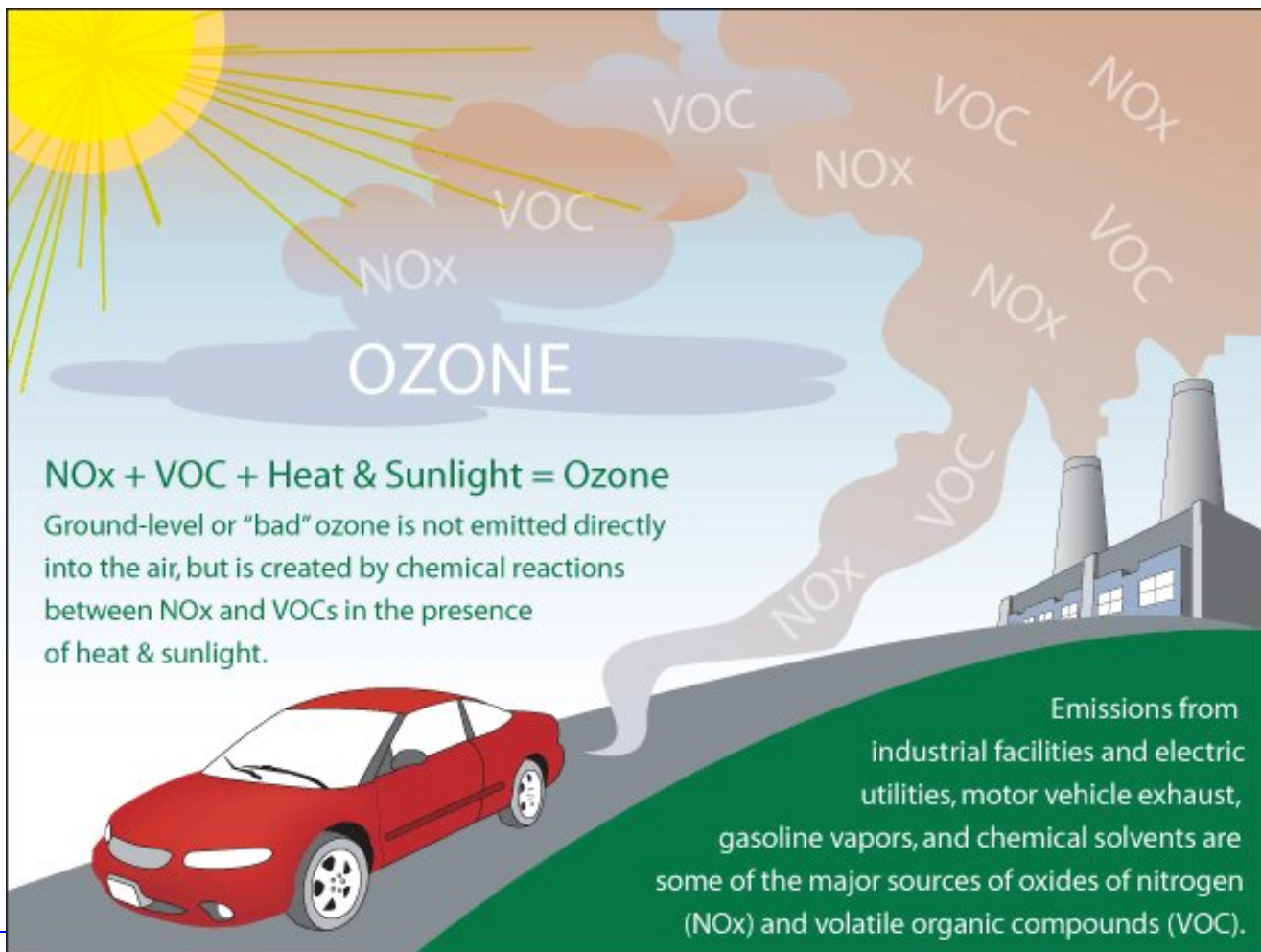
- **Food supplies:** UV can also damage sensitive crops, such as soybeans, and reduce crop yields. Some scientists suggest that marine phytoplankton, which are the base of the ocean food chain, are already under stress from UV radiation.
  - This stress could have adverse consequences for human food supplies from the oceans.

## Efforts to Check the Depletion of Stratospheric Ozone

- Over 180 countries recognized the threats posed by ozone depletion and in 1987 adopted a treaty called the **Montreal Protocol** to phase out the production and use of ozone-depleting substances.
  - The 1987 Montreal Protocol on Substances that deplete the Ozone Layer and its succeeding amendments were subsequently negotiated to control the consumption and production of anthropogenic (ODSs) and some hydrofluorocarbons (HFCs).
  - Montreal Protocol deals with the development of replacement of substances, firstly hydrochlorofluorocarbons (HCFCs) and then HFCs, in a number of industrial sectors.
  - While HFCs have only a minor effect on stratospheric ozone, some HFCs are powerful greenhouse gases (GHGs).
  - The adoption of the **2016 Kigali Amendment to the Montreal Protocol** will phase down the production and consumption of some HFCs and avoid much of the projected global warming increase and associated climate change.
- India, a signatory to the Protocol since 1992, has been proactive in compliance and played a key role in achieving the historic Kigali Amendment last year for phasing down Hydrofluorocarbons (HFCs), powerful greenhouse gases contributing to global climate change.
  - India is one among the few countries globally and a pioneer in some cases in the use of technologies, which are non-Ozone Depleting and have a low Global Warming Potential (GWP).
  - India has consciously chosen a path for environment friendly and energy efficient technologies while phasing out Ozone Depleting Substances (ODSs).
- India has **successfully achieved the complete phase out of Hydrochlorofluorocarbon (HCFC)-141 b**, which is a chemical used by foam manufacturing enterprises and one of the most potent ozone depleting chemical after Chlorofluorocarbons (CFCs)
  - (HCFC)-141 b is used mainly as a blowing agent in the production of rigid polyurethane (PU) foams.

## What Causes Ground Level Ozone?

- **Ground-level or “bad” ozone** is not emitted directly into the air, but is created by **chemical reactions between oxides of nitrogen (NO<sub>x</sub>) and volatile organic compounds (VOC)** in the presence of sunlight.
  - Emissions from industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are some of the major sources of NO<sub>x</sub> and VOC. At ground level, ozone is a **harmful pollutant**.
- **Ozone pollution during the summer months:** It is because strong sunlight and hot weather result in harmful ozone concentrations in the air we breathe. In this time urban and suburban areas had a prevalence of high levels of ground level ozone.
  - But many rural areas of the country are also subject to high ozone levels as winds carry emissions hundreds of miles away from their original sources.



## Ground Level Ozone and its Effect

- **Human health:** Breathing ozone can trigger a variety of health problems including chest pain, coughing, throat irritation, and congestion. It can worsen bronchitis, emphysema, and asthma.
  - Ground level ozone also can reduce lung function and inflame the linings of the lungs. Repeated exposure may permanently scar lung tissue.
  - Healthy people also experience difficulty breathing when exposed to ozone pollution.
  - Because ozone forms in hot weather, anyone who spends time outdoors in the summer may be affected, particularly children, outdoor workers and people exercising.
- **Vegetation:** Ground-level ozone also damages vegetation and ecosystems.
  - It leads to **reduced agricultural crop** and **commercial forest yields**, reduced growth and survivability of tree seedlings, and increased susceptibility to diseases, pests and other stresses such as harsh weather.
  - Ground-level ozone also damages the foliage of trees and other plants, affecting the landscape of cities, national parks and forests, and recreation areas.

## Efforts to Check Ground Level Ozone

- In India, surface ozone levels are above the recommended threshold of 8 hour average of 100 µg/m<sup>3</sup> for air quality monitoring at various stations. Exposure to high levels of surface ozone causes a number of health problems. Various steps have been taken by the government to reduce ozone pollution are:
  - Shifting to **BS-VI compliant vehicles from BS-IV.**
  - Banning of garbage burning.

- **Graded Response Action Plan (GRAP).**
- Launch of the National Clean Air Programme (NCAP).
- Setting up of a monitoring network for assessment of the ambient air quality at 779 locations, covering 339 cities in 29 states and six Union territories.

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