



Ground-Level Ozone Pollution in India

[Source: HT](#)

Why in News?

A recent study by the [Centre for Science and Environment \(CSE\)](#) has brought attention to the **alarming levels of ground-level ozone (O₃)** in major cities across India.

- The findings raise serious concerns about public health, particularly for vulnerable populations such as those with [respiratory issues](#).

What are the Key Findings of the Study?

- **High Ozone Exceedance in Major Cities:** Delhi-NCR recorded **176 days of ground-level ozone exceedance** between 1st January and 18th July 2023, leading the list. **Mumbai and Pune** followed with 138 days each, while Jaipur had 126 days.
 - Contrary to expectations, **ozone levels remained high after sunset** in several cities, with Mumbai logging 171 nights of exceedance, and Delhi-NCR 161 nights.
 - Compared to last year, **seven out of ten cities saw increased ozone exceedances**, with Ahmedabad's rising by 4,000%, followed by Pune, with a 500% rise and Jaipur, with a 152% rise.
- **Standards and Measurement Issues:** The 8-hourly standard for ozone is set at 100 µg/m³. The one-hour standard is 180 µg/m³.
 - The study highlights that the [Central Pollution Control Board](#) caps data at 200 µg/m³, making it difficult to fully assess the severity of exceedances.
- **Health Risks:** Exposure to ground-level ozone can cause respiratory problems, including **chest pain, coughing, bronchitis, emphysema, and asthma**, and can also inflame and damage the lining of the lungs, leading to long-term health issues.
- **Green Areas Worst Affected:** High-end, green neighbourhoods were found to be **hotspots for ground-level ozone**, challenging the assumption that these areas are safer in terms of air quality.
 - Ozone tends to accumulate in cleaner areas where fewer gaseous pollutants are available to react with it.
- **Inverse Spatial Distribution:** The study found that the spatial distribution of ozone is **inversely related to [nitrogen dioxide \(NO₂\)](#) and [particulate matter \(PM_{2.5}\)](#)**. While ozone is created in polluted areas, it tends to drift and accumulate in areas with less NO₂, making these **areas more vulnerable to higher ozone concentrations**.

What is Ground-Level Ozone?

- **About:** Ground-level ozone, or **tropospheric ozone**, is a secondary pollutant formed when **nitrogen oxides (NO_x)** and **volatile organic compounds (VOCs)** from vehicles, industries, and power plants react in the presence of sunlight, with levels rising especially during summer. It is a **colourless gas** forming just above the Earth's surface.
 - Unlike the beneficial ozone layer in the stratosphere, which protects the Earth from **harmful [ultraviolet \(UV\) radiation](#)**, ground-level ozone is a harmful air pollutant it is often referred to as "**bad ozone**".

- Rising temperatures, especially during [heatwaves](#), worsen ground-level ozone formation, leading to dangerous [air quality in cities like New Delhi](#) when ozone levels exceed permissible limits.
- **Impact: A significant increase in ozone-attributable deaths has been observed globally, with South Asia, including India, showing the highest rise. Projections suggest that by 2050, more than a million deaths in India could be linked to ozone exposure if emissions of its precursor gases are not adequately controlled.**
 - Ground-level ozone is detrimental to **crop health, reducing yields and seed quality**. Essential crops like **wheat and rice**, which are staples in India, are particularly **vulnerable to ozone pollution**, threatening food security.
- **Concerns for India: India is home to 10 of the world's 15 most polluted cities, with air quality far exceeding [World Health Organization \(WHO\) guidelines](#).**
 - The poor air quality, rising temperatures, and frequent heat waves make India vulnerable to the harmful effects of ground-level ozone.
 - The **country's growing and ageing population** is increasingly at risk from the health impacts of ozone pollution, and the public health burden is likely to increase as more people are exposed to this pollutant.
- **Challenge in Reducing Ground-Level Ozone: Unlike other air pollutants, ground-level ozone is part of a cyclical chemical reaction. Reducing precursor gases (NO_x and VOCs) does not necessarily reduce ozone levels, and if conditions are not carefully managed, ozone can linger in the atmosphere, leading to prolonged exposure.**
 - **Expanding air quality monitoring and implementing alerts like Delhi** can help mitigate ozone pollution by informing the public and industries when to take preventive actions.



Air Pollutants

Sulphur Dioxide (SO₂)



It comes from the consumption of fossil fuels (oil, coal and natural gas). Reacts with water to form acid rain.

Impact: Causes respiratory problems.

Ozone (O₃)



Secondary pollutant formed from other pollutants (NO_x and VOC) under the action of the sun.

Impact: Irritation of the eye and respiratory mucous membranes, asthma attacks.

Nitrogen Dioxide (NO₂)



Emissions from road transport, industry and energy production sectors. Contributes to Ozone and PM formation.

Impact: Chronic lung disease.

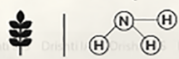
Carbon Monoxide (CO)



It is a product of the incomplete combustion of carbon-containing compounds.

Impact: Fatigue, confusion, and dizziness due to inadequate oxygen delivery to the brain.

Ammonia (NH₃)



Produced by the metabolism of amino acids and other compounds which contain nitrogen.

Impact: Immediate burning of the eyes, nose, throat and respiratory tract and can result in blindness, lung damage.

Lead (Pb)



Released as a waste product from extraction of metals such as silver, platinum, and iron from their respective ores.

Impact: Anemia, weakness, and kidney and brain damage.

Particulate Matter (PM)



PM10: Inhalable particles, with diameters that are generally 10 micrometers and smaller.

PM2.5: Fine inhalable particles, with diameters that are generally 2.5 micrometers and smaller.

Source: Emitted from construction sites, unpaved roads, fields, fires.

Impact: Irregular heartbeat, aggravated asthma, decreased lung function.

Note: These major air pollutants are included in the Air quality index for which short-term National Ambient Air Quality Standards are prescribed.



Initiatives to Control Air Pollution

- [Graded Response Action Plan](#)
- [The Commission for Air Quality Management in National Capital Region \(NCR\) and Adjoining Areas.](#)
- [Bharat Stage \(BS\) VI norms.](#)
- [National Clean Air Programme.](#)

- [National Air Quality Index \(AQI\).](#)
- [Air \(Prevention and Control of Pollution\) Act, 1981.](#)

UPSC Civil Services Examination Previous Year Question (PYQ)

Prelims

Q. Consider the following: (2019)

1. Carbon monoxide
2. Methane
3. Ozone
4. Sulphur dioxide

Which of the above are released into atmosphere due to the burning of crop/biomass residue?

- (a) 1 and 2 only
(b) 2, 3 and 4 only
(c) 1 and 4 only
(d) 1, 2, 3 and 4

Ans: (d)

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