World Air Quality Report 2023

Source: TH

Why in News?

India has been identified as the **world's third most polluted country,** as per the World Air Quality Report **2023** by Swiss organisation IQAir.
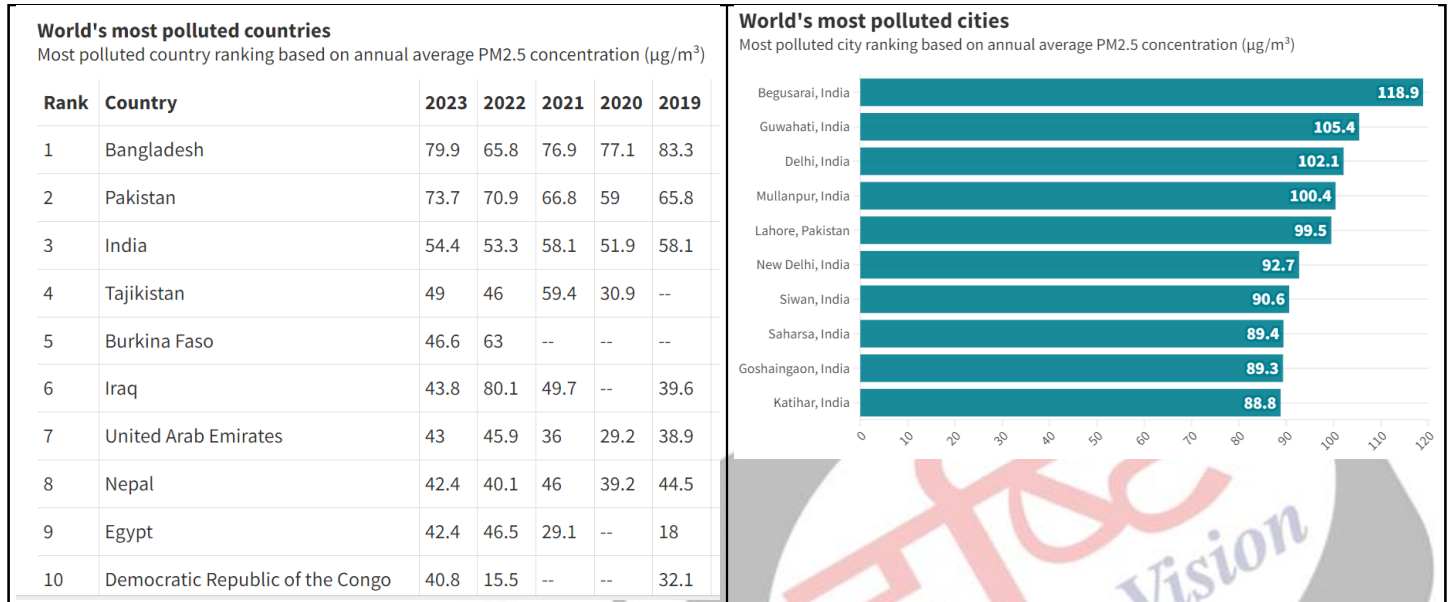
What are the Key Highlights of the World Air Quality Report 2023?

- **India's Air Quality Ranking:**
    - Ranked as the **world's third most polluted country,** with an average annual **PM2.5 concentration** of **54.4 micrograms per cubic meter.**
        - **Bangladesh** and Pakistan surpassed India in **pollution** levels, becoming the most and second most polluted countries, respectively.
        - **9 out of the top 10 most polluted cities in the world are from India.**
    - **India's air quality** deteriorated compared to the previous year, with Delhi emerging as the world's most polluted capital city for the fourth consecutive time.
    - **Begusarai in Bihar is labelled as the world's most polluted metropolitan area,** with an average PM2.5 concentration of 118.9 micrograms per cubic meter.
    - **Health Impacts and WHO Guidelines:**
        - Around **136 million Indians (96% of the Indian population)** face PM2.5 concentrations (seven times) higher than the **World Health Organization's** recommended levels of **5 micrograms per cubic meter.**
            - Over 66% of Indian cities have reported **annual averages higher than 35 micrograms per cubic metre (µg/m^3).**
        - PM2.5 pollution, primarily from burning **fossil fuels**, is linked to increased rates of heart attack, stroke, and oxidative stress, with severe health implications.
- **Global Air Quality:**
    - Seven countries that met the WHO annual PM2.5 guideline (annual average of 5 µg/m^3 or less) included **Australia, Estonia, Finland, Grenada, Iceland, Mauritius, and New Zealand.**
    - The report states that **Africa continues to be the most underrepresented continent,** with a third of its population lacking access to air quality data.
    - Some countries, including **China and Chile,** reported decreases in PM2.5 pollution levels, indicating progress in combating air pollution.
    - Pollution does not stay confined to its source, with prevailing winds distributing it across regions, emphasising the need for international cooperation in addressing air quality

issues.
- ◦ **Global Impact of Air Pollution:**
  - • Air pollution causes approximately **seven million premature deaths worldwide annually.** It contributes to approximately **one in every nine deaths worldwide.**
  - • PM2.5 exposure leads to health issues like **asthma, cancer, stroke, and mental health complications.**
  - • Exposure to elevated levels of fine particles can **impair** cognitive development **in children**, lead to mental health issues, and complicate existing illnesses, including diabetes.

World's most polluted countries
Most polluted country ranking based on annual average PM2.5 concentration (µg/m³)

Rank	Country	2023	2022	2021	2020	2019
1	Bangladesh	79.9	65.8	76.9	77.1	83.3
2	Pakistan	73.7	70.9	66.8	59	65.8
3	India	54.4	53.3	58.1	51.9	58.1
4	Tajikistan	49	46	59.4	30.9	--
5	Burkina Faso	46.6	63	--	--	--
6	Iraq	43.8	80.1	49.7	--	39.6
7	United Arab Emirates	43	45.9	36	29.2	38.9
8	Nepal	42.4	40.1	46	39.2	44.5
9	Egypt	42.4	46.5	29.1	--	18
10	Democratic Republic of the Congo	40.8	15.5	--	--	32.1

World's most polluted cities
Most polluted city ranking based on annual average PM2.5 concentration (µg/m³)

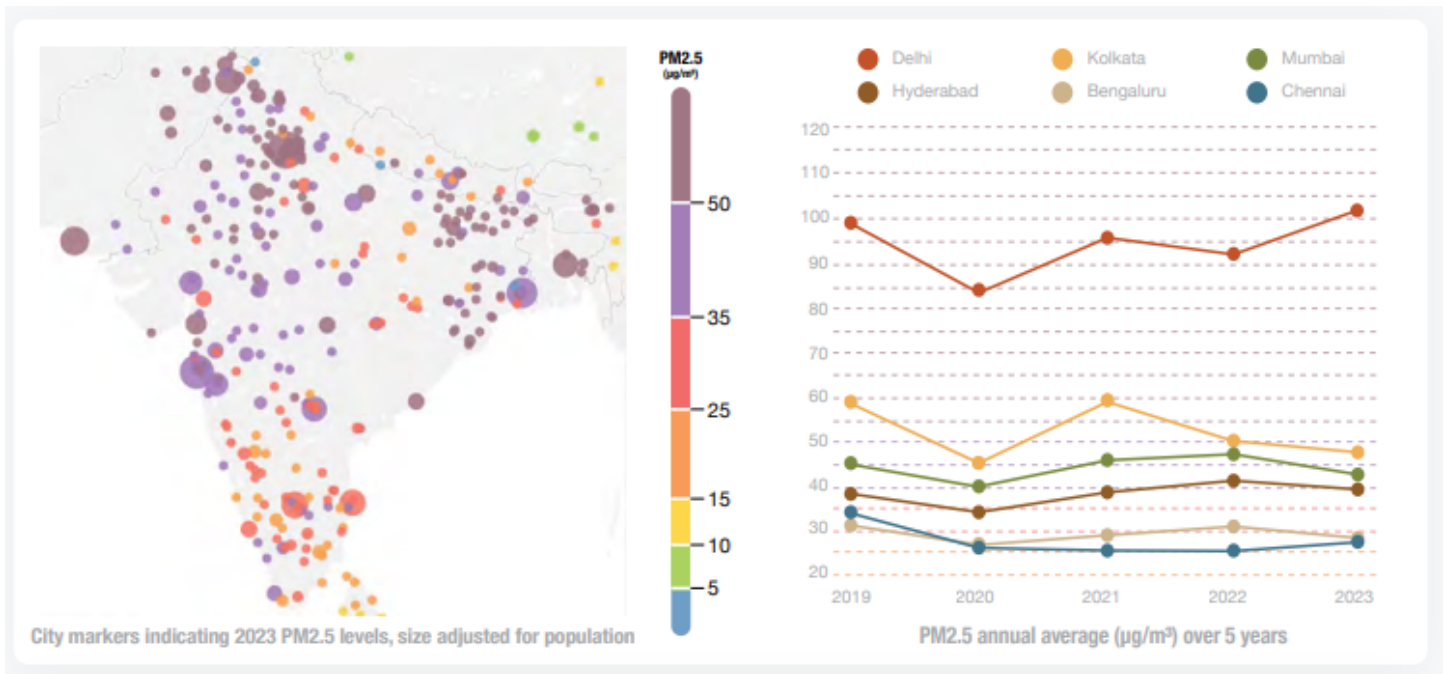| City	PM2.5
Begusarai, India	118.9
Guwahati, India	105.4
Delhi, India	102.1
Mullanpur, India	100.4
Lahore, Pakistan	99.5
New Delhi, India	92.7
Siwan, India	90.6
Saharsa, India	89.4
Goshaingaon, India	89.3
Katihar, India	88.8

What are the WHO Air Quality Guidelines?

- ▪ **Pollutants Covered:**
  - ◦ The World Health Organization (WHO) regularly updates its evidence-based air quality guidelines to safeguard public health from the ongoing threat of air pollution. The most **recent update occurred in 2021**, revising the guidelines that were originally published in 2005.
  - ◦ The guidelines cover both **particulate matter (PM)** and gaseous pollutants, including PM2.5, PM10, ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), **and** carbon monoxide (CO).

Recommended 2021 AQG levels compared to 2005 air quality guidelines

Pollutant	Averaging Time	2005 AQGs	2021 AQGs
$PM_{2.5}$, µg/m³	Annual	10	5
	24-hour[a]	25	15
PM_{10}, µg/m³	Annual	20	15
	24-hour[a]	50	45
O_3, µg/m³	Peak season[b]	-	60
	8-hour[a]	100	100
NO_2, µg/m³	Annual	40	10
	24-hour[a]	-	25
SO_2, µg/m³	24-hour[a]	20	40
CO, mg/m³	24-hour[a]	-	4

City markers indicating 2023 PM2.5 levels, size adjusted for population
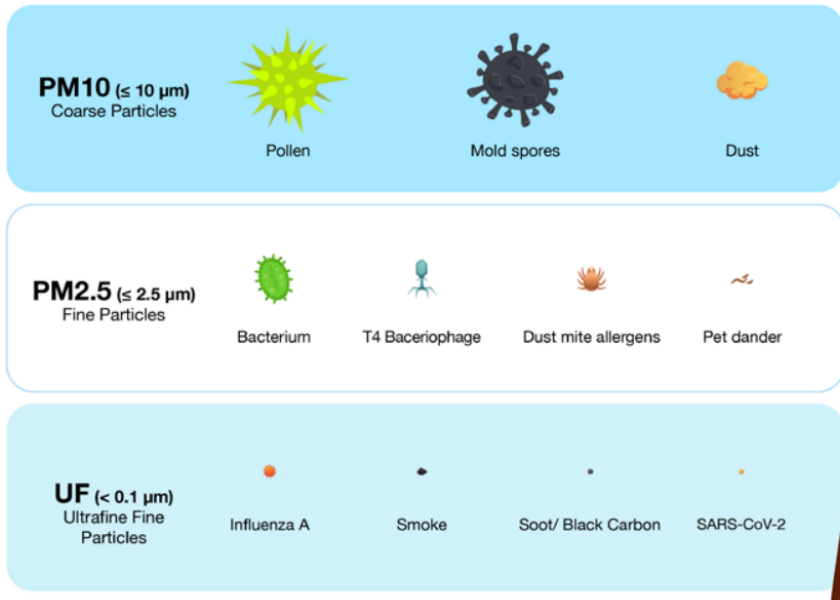
PM2.5 annual average (µg/m³) over 5 years

Particulate Matter (PM)

- Particulate matter, or PM, refers to a complex mixture of extremely **small particles and liquid droplets** suspended in the air. These particles come in a wide range of sizes and can be made up of hundreds of different compounds.
    - **PM10 (coarse particles)** - Particles with a diameter of 10 micrometres or less.
    - **PM2.5 (fine particles)** - Particles with a diameter of 2.5 micrometres or less.

Particulate Size Matters: **Comparing sizes**

Small particles pose the greatest risk to human health. While the nose can filter most coarse particles, fine and ultrafine particles are inhaled deeper into the lungs where they can be deposited or even pass into the bloodstream.

Measurement indicate microns in diameter (µm).

PM10 (≤ 10 µm)
Coarse Particles

Pollen   Mold spores   Dust

PM2.5 (≤ 2.5 µm)
Fine Particles

Bacterium   T4 Baceriophage   Dust mite allergens   Pet dander

UF (< 0.1 µm)
Ultrafine Fine Particles

Influenza A   Smoke   Soot/ Black Carbon   SARS-CoV-2

Human hair
50-180 µm

- **Air pollution**
    - It is the contamination of the environment by **chemicals, physical or biological agents.** Sources include household devices, vehicles, industrial facilities, and forest fires.
        - Major pollutants include particulate matter, carbon monoxide, ozone, nitrogen dioxide, and sulfur dioxide, causing respiratory diseases and high mortality rates.

- WHO data shows that **99% of the global population breathes air exceeding guideline limits,** with low- and middle-income countries suffering the most.
- Air quality is closely linked to the earth's climate and ecosystems, and policies to reduce air pollution offer a win-win strategy for both climate and health.
- All o**f India's 1.4 billion people (100% of the country's population) are exposed to unhealthy levels of ambient PM2.5.**
    - The health impacts of pollution also represent a heavy cost to the economy. Lost output from premature deaths and morbidity attributable to air pollution accounted for economic losses of USD 36.8 billion was 1.36% of India's gross domestic product (GDP).

Air Pollutants

Sulphur Dioxide (SO_2)

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 (O_3)

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

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

Nitrogen Dioxide (NO_2)

Emissions from road transport, industry and energy production sectors. Contributes to Ozone and PM formation.
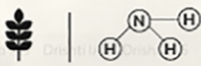
Impact: Chronic lung disease.

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 (NH_3)

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.

What are the Initiatives Taken for Controlling Air Pollution?

- **National Clean Air Programme (NCAP).**
- **Bharat Stage Emission Standards.**
- **Solid Waste Management Rules,2016.**
- **System of Air Quality and Weather Forecasting and Research (SAFAR) Portal.**
- **Air Quality Index.**
- **Graded Response Action Plan.**
- **National Air Quality Monitoring Programme (NAMP).**
- **Commission for Air Quality Management.**
- **Turbo Happy Seeder (THS) Machine.**

Way Forward

- **Regulatory Strengthening:** Implement and enforce strict air quality standards and emission limits, with heavy penalties for non-compliance.
- **Transition to Clean Energy:** Accelerate the adoption of renewable energy sources, phase out fossil fuels, and invest in sustainable transportation options like electric vehicles.
- **Industrial Improvement:** Mandate clean technologies in industries, promote waste minimisation, and offer incentives for pollution control equipment.
- **Public Awareness and Research:** Conduct awareness campaigns, involve the public in decision-making, invest in research for innovative pollution control technologies, and foster public-private partnerships.
- **Global Cooperation and Support:** Collaborate internationally to address transboundary pollution, support developing nations with technical assistance and funding, and prioritise air quality management as a collective responsibility.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q. In the cities of our country, which among the following atmospheric gases are normally considered in calculating the value of the Air Quality Index? (2016)

1. Carbon dioxide
2. Carbon monoxide
3. Nitrogen dioxide
4. Sulphur dioxide
5. Methane

Select the correct answer using the code given below:

(a) 1, 2 and 3 only
(b) 2, 3 and 4 only
(c) 1, 4 and 5 only
(d) 1, 2, 3, 4 and 5

Ans: (b)

Mains

Q. Describe the key points of the revised Global Air Quality Guidelines (AQGs) recently released by the World Health Organisation (WHO). How are these different from its last update in 2005? What changes in

India's National Clean Air Programme are required to achieve revised standards? **(2021)**

PDF Refernece URL: