Tackling Air Pollution

Source: HT

Why in News?

The **Indo-Gangetic Plain**, encompassing Delhi, Bihar, Chandigarh, Haryana, Punjab, Uttar Pradesh, and West Bengal, has recently been severely affected by **intense air pollution**.

- For instance, in Delhi, the **Air Quality Index (AQI)** rose to **approximately 500**, highlighting the **severe air pollution** challenge in the IGP, which is home to **9% of the global population and 40% of India's population.**

What is the Status of Air Pollution in India?

- **Leads in Worst-Polluted Cities:** India has the highest number of cities in the **top 100** most polluted cities globally, with **39 cities** ranked among them, surpassing **China**, which has **30 cities** in the list.
- **Regional Comparison:** Other South Asian countries contribute significantly to global pollution, with **Pakistan having 7 cities, Bangladesh 5, and Nepal 2** cities in the top 100.
  - **53** of the top 100 polluted cities are in the **Indian subcontinent.**
- **Life Expectancy Reduction:** According to a **2019 study** by the **Energy Policy Institute at the University of Chicago (EPIC)**, residents of IGP have an average **life expectancy shorter by seven years** compared to other parts of the country due to severe air pollution.

THE UNWANTED CROWN

Country	Number of cities in top 100 most polluted
India	39
China	30
Pakistan	7
Bangladesh	5
Iran	3
South Africa	3
Nepal	2
Indonesia	2

The list includes top 6 countries, hence the total is not 100
Source: S&P Global Mobility

Top ten most polluted countries (2023)

Rank	Country	Average PM 2.5 ug/m3
1	Bangladesh	79.9
2	Pakistan	73.7
3	India	54.4
4	Tajikistan	49.0
5	Burkina Faso	46.6
6	Iraq	43.8
7	UAE	43.0
8	Nepal	42.4
8	Egypt	42.4
9	Congo	40.8

Source: iQAir

What is AQI?

- **About:** AQI is a **numerical scale** used to measure and communicate the quality of air based on the concentration of **major pollutants.**
    - It was established by the **Environmental Protection Agency (EPA)**.
- **Categories:** There are six AQI categories:
    - Good, Satisfactory, Moderately polluted, Poor, Very Poor, and Severe.
- **Pollutants Covered:** AQI considers **eight** pollutants namely **PM 10, PM 2.5, Nitrogen Dioxide (NO_2), Sulphur Dioxide (SO_2), Carbon Monoxide (CO), Ozone (O_3), Ammonia (NH_3), and Lead (Pb)**.
- **Scale of AQI:** The AQI ranges from **0 to 500**, with higher values indicating **worse air quality** and greater health risks.

AQI Category	AQI	Concentration Range*							
		PM$_{10}$	PM$_{2.5}$	NO$_2$	O$_3$	CO	SO$_2$	NH$_3$	Pb
Good	0-50	0-50	0-30	0–40	0-50	0-1.0	0-40	0-200	0-0.5
Satisfactory	51 - 100	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400	0.5-1.0
Moderately Polluted	101-200	101-250	61-90	81-180	101-168	2.1-10	81-380	401-800	1.1-2.0
Poor	201-300	251-350	91-120	181-280	169-208	10-17	381-800	801-1200	2.1-3.0
Very Poor	301–400	351-430	121-250	281-400	209-748*	17-34	801-1600	1200-1800	3.1-3.5
Severe	401-500	430+	250+	400+	748+*	34+	1600+	1800+	3.5+

* CO in mg/m^3 and other pollutants in µg/m^3; 24-hourly average values for PM$_{10}$, PM$_{2.5}$, NO$_2$, SO$_2$, NH$_3$, and Pb, and 8-hourly values for CO and O$_3$.

- **Effects of Bad Air Quality:**
    - **Short-Term Effects:** Symptoms such as **headaches, nasal congestion, and skin irritation** are common when exposed to poor air quality.
        - Conditions like **asthma, allergic rhinitis, and pneumonia** may be triggered or worsened by high levels of pollutants.
    - **Long-Term Health Risks:**
        - **Chronic Respiratory Diseases:** Asthma, chronic obstructive pulmonary disease (COPD), and even lung cancer.
        - **Cardiovascular Health:** Like heart attacks, strokes, heart failure, and hypertension.
        - **Cognitive Decline:** Cognitive decline, dementia, and strokes, particularly in older adults.
        - **Skin:** Eczema and dermatitis.
        - **Internal Organ Damage:** Damage to internal organs, including the kidneys and liver.
    - **Impact on Vulnerable Groups:**
        - **Pregnant Women:** Disrupt placental development, harm foetal growth, and cause long-term health issues in children.
        - **Children:** Hinder neurological development, affecting cognitive and physical growth.

Air Pollutants

Sulphur Dioxide (SO₂)
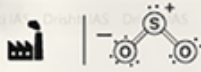
It comes from the consumption of fossil fuels (oil, coal and natural gas). Reacts with water to form acid rain.

Impact: Causes respiratory problems.

Ozone (O₃)

Secondary pollutant formed from other pollutants (NOx 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.

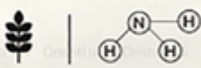**Impact:** Chronic lung disease.

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.

What are the Causes of Air Pollution?

- **Temperature Inversions:** It occurs in **November and December** when cold air mixes with **pollutants, trapping** them near the ground. This exacerbates air pollution by preventing the dispersion of harmful particles.
- **Traffic Congestion:** Traffic congestion is a key contributor to air pollution, with Mumbai having the highest vehicle density per kilometre, followed by Kolkata, Pune, and Delhi.
  - In densely populated urban areas, **heavy traffic not only exacerbates air pollution** but also hinders efforts to improve air quality through cleaner technologies and more efficient urban planning.
  - **For example, in cities like Delhi**, despite the introduction of electric buses and stricter emission norms, traffic congestion continues to undermine air quality improvements.
- **Stubble Burning** and **Desert Dust:** The widespread burning of **crop residues** releases smoke, carbon dioxide, and particulate matter, significantly worsening air quality.
  - Additionally, winds from the **Thar Desert** **bring fine dust particles** into the region, further intensifying air pollution.
- **Fireworks:** The burning of fireworks releases **toxic chemicals, heavy metals**, and fine particulate matter into the air, which contribute to **short-term surges** in air pollution and deteriorating air quality.
- **Biomass Burning:** In rural areas, the reliance on traditional methods of cooking and heating, such as using **firewood, biomass fuels, or coal,** contributes to both indoor and outdoor air pollution.

What are the Initiatives Related to Controlling Air Pollution in India?

- **National Clean Air Programme**
- **System of Air Quality and Weather Forecasting and Research (SAFAR) Portal**
- **New Commission for Air Quality Management**
- **Graded Response Action Plan (for Delhi)**
- **For Reducing Vehicular Pollution:**
  - **BS-VI Vehicles**
  - **National Electric Mobility Mission Plan**

WHO's 4 Pillar Strategy

- WHO adopted a resolution in **2015** to address the **adverse health effects** of air pollution adopting a **4 Pillar Strategy.**
- **Those four pillars are:**
  - Expanding the knowledge base
  - Monitoring and reporting
  - Global leadership and coordination
  - Institutional capacity strengthening

Way Forward

- **Waste-to-Energy Technologies:** Invest in **waste-to-energy plants** that convert non-recyclable waste into energy through processes like **incineration or anaerobic digestion.**
  - **Incineration** is a thermal process that **burns waste at high temperatures** to reduce its volume, while **anaerobic digestion** is a biological process where microorganisms **break down organic waste** without oxygen.
- **Covering Construction Sites:** Measures like vertically covering the construction area, covering raw materials, use of **water spray and windbreaker** to prevent sand and dust from dispersing

and covering construction materials can significantly improve air quality.

- **De-SOx-ing and De-NOx-ing Systems:** To limit pollutants like **sulphur dioxide (SO2) and nitrogen oxides (NOx),** plants and refineries need to install De-SOx-ing and De-NOx-ing systems that remove SO2 and NOx respectively.
- **Alternative Biomass Uses:** Instead of burning, the residue can be used for energy production, **biogas generation** and feeding cattle.
- **Shift Toward Electrification**: Promoting **electric, hybrid, and BS-VI vehicles,** along with improving public transport, can reduce vehicular emissions significantly.
- **Vapour Recovery Systems:** Petrol vapours, containing **volatile organic compounds (VOCs),** contribute to smog and pose health risks during storage unloading and refuelling.
  - **Vapour recovery systems** capture VOCs to reduce emissions.

Drishti Mains Question:

Critically analyse the factors contributing to severe air pollution in the Indo-Gangetic Plain. Suggest measures to address the issue effectively.

UPSC Civil Services Examination Previous Year Question (PYQ)

Prelims

Q. Which of the following are the reasons/factors for exposure to benzene pollution? (2020)

1. Automobile exhaust
2. Tobacco smoke
3. Wood burning
4. Using varnished wooden furniture
5. Using products made of polyurethane

Select the correct answer using the code given below:

(a) 1, 2 and 3 only

(b) 2 and 4 only

(c) 1, 3 and 4 only

(d) 1, 2, 3, 4 and 5

Ans: (a)

Q. In the context of solving pollution problems, what is/are the advantage/advantages of bioremediation techniques? (2017)

1. It is a technique for cleaning up pollution by enhancing the same biodegradation process that occurs in nature.
2. Any contaminant with heavy metals such as cadmium and lead can be readily and completely treated by bioremediation using microorganisms.
3. Genetic engineering can be used to create microorganisms specifically designed for bioremediation.

Select the correct answer using the code given below:

(a) 1 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

Ans: (c)

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)**

Q. What are the key features of the National Clean Air Programme (NCAP) initiated by the government of India? **(2020)**

PDF Refernece URL: https://www.drishtiias.com/printpdf/tackling-air-pollution