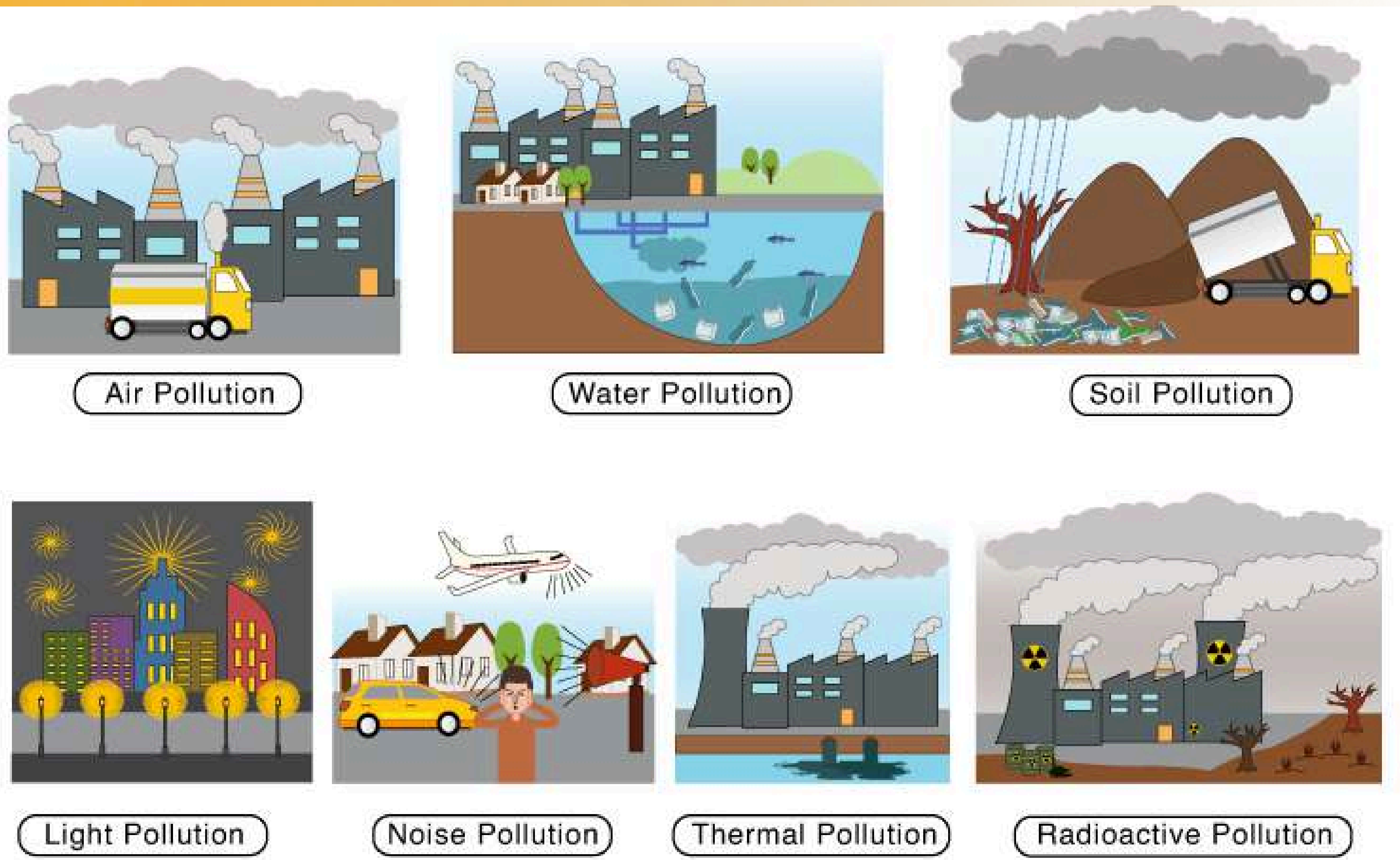
Pollution

Pollution is defined as introducing harmful substances (solid, liquid, or gas) or any form of energy (light, heat, sound, or radioactivity) into the environment. The harmful elements that damage air, water, and land quality and cause pollution are called pollutants.

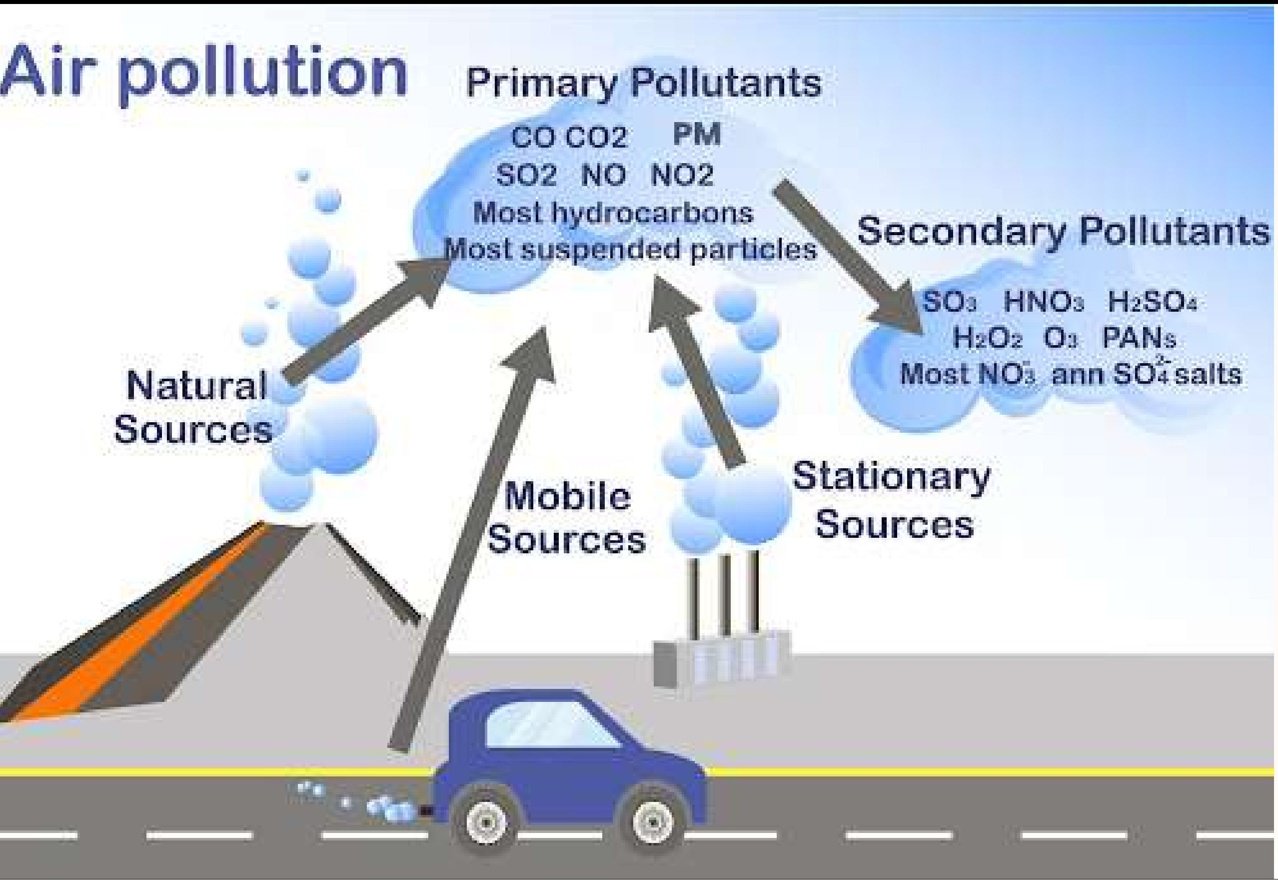


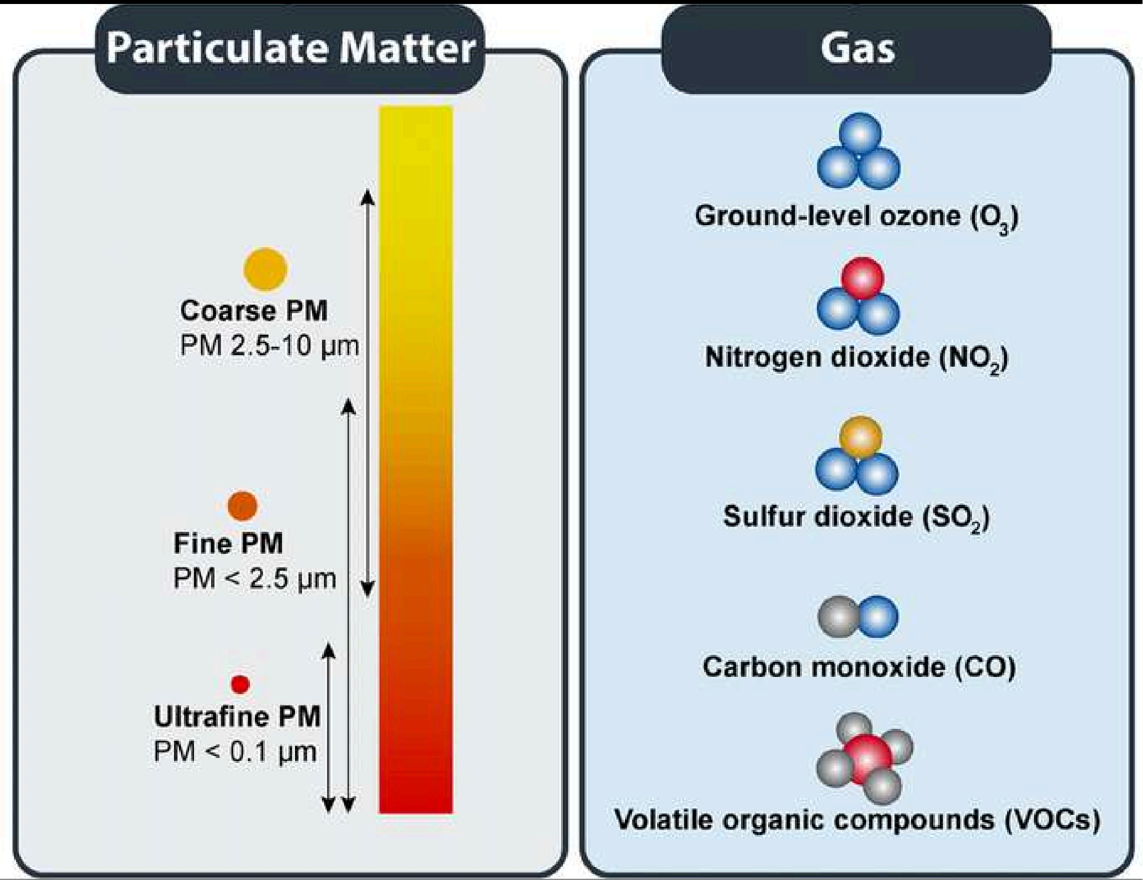
Air Pollution

DIRECTION IAS

The air in our atmosphere has a roughly stable chemical composition consisting of nitrogen, oxygen, argon, carbon dioxide, and trace amounts of other gases. Any change in the air composition due to the addition of unwanted gases such as sulfur dioxide, carbon monoxide, and nitrogen oxides, chemicals, particulate matter, and biological molecules is called air pollution.

Primary air pollutants are emitted directly into the atmosphere from sources, while **secondary air pollutants** form in the atmosphere through chemical reactions between primary pollutants and other substances. Examples of primary pollutants include carbon monoxide, sulfur dioxide, and particulate matter, while secondary pollutants include ozone, acid rain, and photochemical smog.





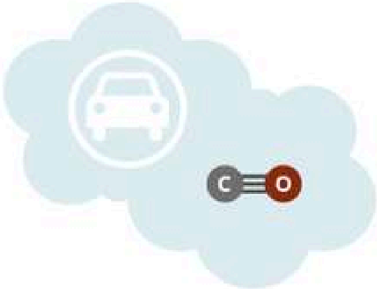
Air pollution can happen from both human-made (anthropogenic) and natural sources.

Some of the significant sources of air pollution are given below:

- Burning of fossil fuels such as coal, oil, and natural gas
- Exhaust from automobiles and industries
- Indiscriminate cutting of trees (deforestation)
- Wildfires resulting from burning stubble and farm residues
- Release of methane from microbial decay
- Excessive discharge of greenhouse gases like carbon dioxide and nitrous oxide
- Chlorofluorocarbons (CFCs) released from aerosols sprays, refrigerants, and air conditioners
- Release volcanic ash and gases

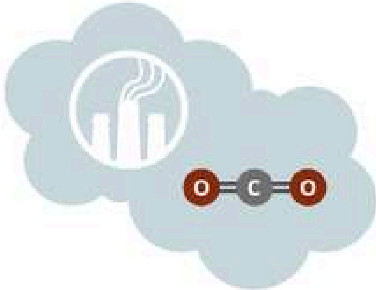
A BRIEF GUIDE TO ATMOSPHERIC POLLUTANTS

A number of different chemical entities, from a range of sources, can contribute towards atmospheric pollution, the consequences of which can include global warming and smog. This graphic looks at a selection of major groups of atmospheric pollutants, their major sources, and their effects.



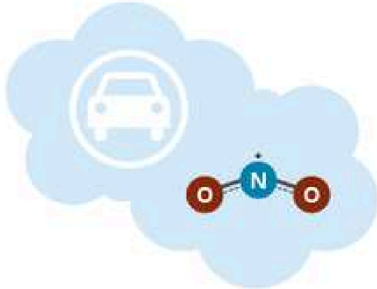
CARBON MONOXIDE

A gas generated by the incomplete combustion of fuels – primarily from road transport. Affects human health, as it reduces oxygen-carrying capacity of the blood. It also reacts with other atmospheric gases to produce ozone.



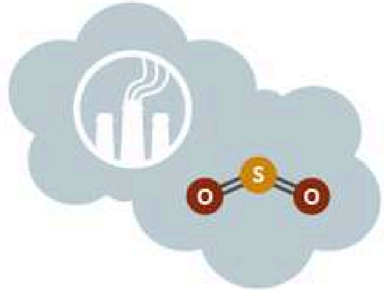
CARBON DIOXIDE

A gas generated by the burning of fossil fuels in the production of electricity. Also emitted by natural processes. Human emissions are linked with rising atmospheric CO_2 levels and anthropogenic global warming.



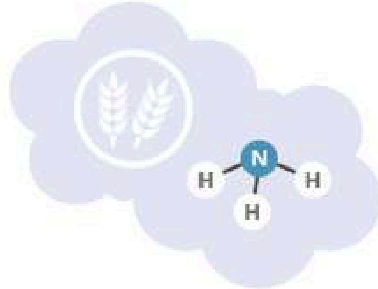
NITROGEN OXIDES

Primarily created by combustion in road transport. Nitrous oxide is an important global warming contributor, whilst nitrogen dioxide is involved in ground-level ozone forming reactions, and is also a component of smog.



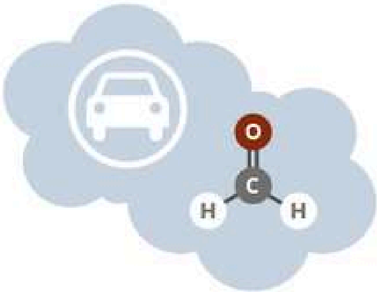
SULFUR DIOXIDE

The primary source of sulfur dioxide is the burning of fossil fuels to generate electricity. It can contribute to smog, reacts with water to produce acid rain, and can also cause wheezing and breathing problems for asthmatics.



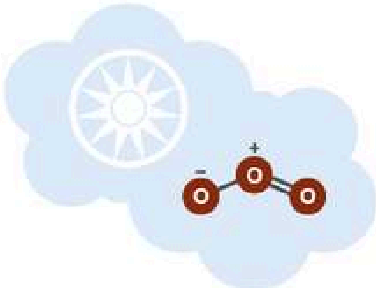
AMMONIA

Ammonia's primary atmospheric source is from its use in agriculture, such as manure & fertilisers. It can react with other pollutants to produce particulate matter. It also has the ability to over-enrich ecosystems with nitrogen.



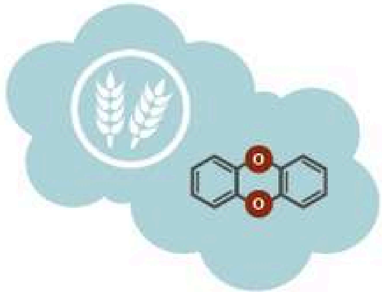
VOCs

VOCs (volatile organic compounds) are emitted naturally by vegetation. Amongst significant human sources is road transport, as well as solvents. They can contribute to formation of ground-level ozone and smog.



OZONE

The ozone layer shields us from UV radiation, but ground-level ozone is a major pollutant. It's formed from other pollutants in the presence of sunlight. Ozone is a major component of smog, and can also cause health effects.

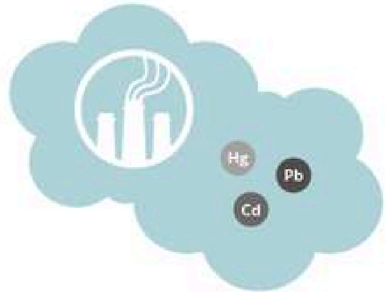


POPs

POPs (persistent organic pollutants) are volatile chemicals released into the atmosphere, often from agricultural or industrial uses. They persist in the environment and can have health effects on both wildlife & humans.

PARTICULATE MATTER

Particulate matter is composed of a huge number of different components. Some are directly emitted, while others are generated by reactions in the atmosphere. They cause haze and can also cause lung problems if inhaled.



HEAVY METALS

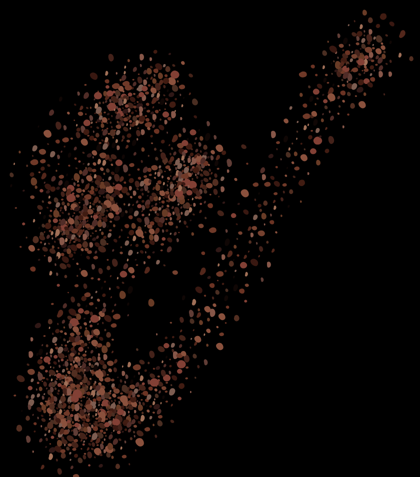
Heavy metals are released into the atmosphere from a range of sources, including burning of fossil fuels and road transport emissions. Some, such as mercury and lead, have toxic health effects in humans.

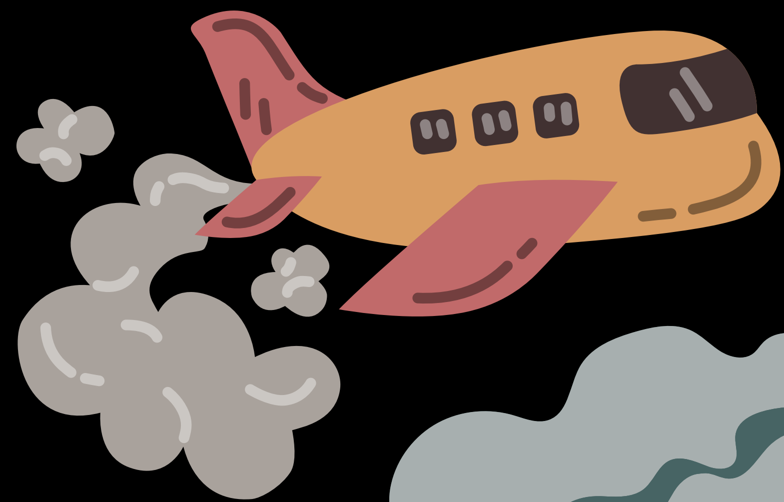
Primary air pollutants

These are emitted directly from identifiable sources, such as vehicles, power plants, and industrial facilities.

Examples:

- Carbon monoxide
- Sulfur dioxide
- Nitrogen oxides
- Hydrocarbons
- Particulate matter (dust, ash, soot)





Carbon monoxide (CO) pollution, primarily from the incomplete combustion of fuels like those from vehicle exhaust, furnaces, and stoves, causes health problems by binding to hemoglobin in the blood and blocking oxygen transport to the body's organs. The effects range from headaches, dizziness, and confusion at low levels to cardiovascular damage, brain damage, and death at high levels.

Causes of carbon monoxide pollution

- Vehicular emissions: The largest source of outdoor CO pollution comes from the exhaust of cars, trucks, and buses.
- Residential heating: Malfunctioning or unvented gas space heaters, furnaces, and gas stoves can release CO into a home.
- Fuel-burning appliances: Other sources include generators, fireplaces, and ovens that burn fossil fuels.
- Incomplete combustion: CO is a byproduct of incomplete combustion, which occurs when there isn't enough oxygen to fully burn fuels like gasoline, natural gas, coal, or wood.

Health effects

- Reduced oxygen transport: CO has a much higher affinity for hemoglobin than oxygen, forming carboxyhemoglobin and preventing the blood from carrying oxygen to organs and tissues.
- Mild to moderate symptoms: Low to moderate exposure can cause headaches, fatigue, dizziness, nausea, and confusion.
- Cardiovascular effects: For people with existing heart conditions, this can lead to chest pain (angina) because the heart muscle doesn't get enough oxygen, especially under stress or during exercise.

- Severe and fatal effects: At very high concentrations, CO can cause loss of consciousness, brain damage, and death within a short period. It is particularly dangerous for people who are sleeping.
- Fetal development: High exposure for pregnant women can lead to adverse developmental effects in the unborn baby.

Sulfur dioxide pollution causes adverse health effects like respiratory issues and contributes to environmental problems such as acid rain.

Its causes are primarily from

- burning sulfur-containing fossil fuels in power plants and
- industrial processes like oil refining, metal smelting, and cement manufacturing.

Other sources include

- shipping,
- volcanic activity, and
- geothermal fields.

Health effects Respiratory irritation:

- irritates the nose, throat, and airways, leading to coughing, wheezing, and shortness of breath.
- Aggravated pre-existing conditions: It can worsen conditions like asthma, bronchitis, and emphysema, particularly during physical activity.
- Vulnerable populations: Children, the elderly, and people with chronic lung and heart conditions are at higher risk.
- Long-term effects: Long-term exposure to high levels can reduce lung function and increase the risk of hospital admissions.

Environmental effects

- Acid rain When is released into the atmosphere, it reacts with water vapor to form sulfuric acid.This acid is the main component of acid rain, which can acidify lakes and soils, harming aquatic life and vegetation.Acid rain can also accelerate the deterioration of buildings and cultural monuments.
- Particulate matter and smog contributes to the formation of fine particulate matter when it reacts with other compounds like ammonia.This particulate matter is a major component of smog, which reduces air quality.
- PM 2.5is linked to negative impacts on human health, particularly respiratory and cardiovascular issues.
- Damage to ecosystems: Acid rain harms aquatic life, damages forests, and leaches nutrients from the soil.Plant damage: It directly damages plants by disrupting photosynthesis and causing excessive water loss through stomata.

Nitrogen oxides are a group of gases that have significant adverse effects on human health and the environment. These effects are primarily caused by the combustion of fossil fuels and biomass at high temperatures.

Causes of Emissions The primary sources of nitrogen oxides are both natural and human-made:

- Fossil Fuel Combustion: The main human-generated source, primarily from motor vehicle exhaust and fuel burning in power plants, industrial facilities, commercial, and residential heating.
- Agriculture: Excessive use of nitrogen-based fertilizers in agriculture contributes significantly to atmospheric through microbial activity in soils.
- Indoor Sources: Unvented gas stoves, kerosene heaters, wood-burning fireplaces, and tobacco smoke can cause high indoor levels.
- Natural Processes: Natural sources include lightning strikes, microbial activity in soils, and forest fires.

Effects of On Human Health

- Respiratory Issues: irritates the eyes, nose, throat, and lungs. Exposure can lead to coughing, wheezing, shortness of breath, increased airway inflammation, and increased susceptibility to respiratory infections.
- Asthma: Long-term exposure is linked to an increased risk of developing asthma in children and can trigger more severe asthma attacks in people with the condition.
- Severe Exposure: Breathing high levels of can cause rapid burning and swelling of throat tissues, a build-up of fluid in the lungs (pulmonary edema), reduced oxygenation of tissues, and potentially death.
- Particulate Matter Formation: reacts with other compounds in the atmosphere to form fine particulate matter, which can penetrate deep into the lungs and cause or worsen respiratory and heart diseases.

On the Environment

- Acid Rain: reacts with water, oxygen, and other chemicals in the atmosphere to form nitric acid, a main component of acid rain. Acid rain damages trees, crops, buildings, and acidifies aquatic and terrestrial ecosystems, harming fish and plant populations.
- Smog and Ground-level Ozone: is a primary ingredient in the formation of photochemical smog and ground-level ozone when it reacts with volatile organic compounds (VOCs) in the presence of sunlight. Ground-level ozone damages vegetation and can harm human health.
- Eutrophication: Increased nitrogen inputs from NO_{x} emissions can overload water bodies with nutrients, leading to excessive algal growth, which depletes oxygen and creates "dead zones" harmful to aquatic life.
- Climate Change: Nitrous oxide , another nitrogen oxide compound, is a potent greenhouse gas (much more potent per pound than carbon dioxide) that contributes to global warming.
- Visibility Impairment: Nitrate particles formed from contribute to fine atmospheric particles that reduce visibility and create a reddish-brown haze over cities.

DIRECTION IAS

Hydrocarbon pollution

Causes of hydrocarbon pollution

- Incomplete combustion: Primarily from vehicles, this process releases harmful hydrocarbons into the air.
- Oil spills: Accidental spills during the extraction, transport, or dumping of crude oil and petroleum products are major sources of both marine and land pollution.
- Industrial and agricultural waste: Wastewater from industrial facilities and the use of pesticides contribute significantly to hydrocarbon contamination of water and soil.
- Natural sources: While human activities are the primary cause, natural sources also exist.
- Leaking infrastructure: Spills from oil production lines and leaks from underground storage tanks also contribute to pollution.

Effects of hydrocarbon pollution

Human health:

- Respiratory issues: Hydrocarbons can cause respiratory complications and asthma-like symptoms.
- Cancer: Many hydrocarbons are carcinogenic, increasing the risk of cancer, particularly with long-term exposure.
- Neurological effects: Acute exposure can lead to headaches, dizziness, and disorientation, while chronic exposure may result in neurological damage.
- Other health problems: Exposure can also lead to damage to the liver, kidneys, immune system, and cardiovascular system.

Environmental effects:

- Air pollution: Hydrocarbons contribute to smog and other forms of air pollution.
- Water contamination: Spilled oil and other hydrocarbons can contaminate both freshwater sources and oceans. In marine environments, a film can form on the surface, blocking oxygen transfer and harming aquatic life.
- Soil degradation: Pollution can contaminate soil, making it unsuitable for plant growth.
- Plant damage: Hydrocarbons can accelerate plant aging, cause tissue breakdown, and lead to the shedding of leaves, flowers, and twigs.

Particulate matter pollution

DIRECTION IAS

Causes of particulate matter pollution

- Combustion: Burning fossil fuels in vehicles, power plants, and residential heating systems is a major source, releasing soot and other particles.
- Industrial processes: Manufacturing and other industrial activities also release significant amounts of particulate matter.
- Natural sources: Wildfires and volcanic eruptions release ash and gases laden with particulate matter.
- Construction and agriculture: Dust from construction sites, unpaved roads, and agricultural fields contributes to air pollution.
- Secondary formation: Airborne chemicals like nitrogen oxides and volatile organic compounds (VOCs) can react in the atmosphere to form new particulate matter.

Health effects:

- Respiratory problems: Worsening of asthma, bronchitis, and COPD, as well as increased respiratory infections.
- Cardiovascular problems: Increased risk of heart attacks, strokes, and arrhythmias.
- Long-term risks: Can lead to lung cancer and contribute to premature death.
- Developmental issues: Linked to adverse pregnancy outcomes like pre-term birth and low birth weight.

Environmental effects:

- Climate change: Soot particles can absorb and trap heat, contributing to global warming.
- Reduced visibility: Particulate matter creates smog and haze, obscuring views.
- Ecosystem damage: Particles can settle on plants, disrupting their function, and contribute to acid rain, which damages forests and waterways.
- Water pollution: Deposition into water bodies can change nutrient balances and affect aquatic life.

The Asian Tropopause Aerosol Layer (ATAL) weakens the South Asian monsoon by creating a layer of aerosols in the upper troposphere that disrupts atmospheric circulation and radiative balance. This can lead to reduced rainfall and more severe droughts, especially during events like El Niño, when ATAL is intensified.

How ATAL affects the monsoon

- Weakens the South Asian High (SAH): ATAL causes an increase in diabatic heating in the upper troposphere over the SAH region, which leads to an anomalous upward flow. This upward flow decreases adiabatic heating, causing cooling anomalies in the upper troposphere and ultimately weakening the SAH.
- Increases atmospheric stability: A doubled increase in ATAL intensity can cause a temperature inversion in the upper troposphere, which stabilizes the atmosphere and prevents moisture from rising further.
- Reduces moisture transport and latent heat release: The enhanced atmospheric stability caused by ATAL limits the upward movement of moisture. This reduces the amount of latent heat released during condensation, which further weakens the monsoon.
- Disrupts atmospheric circulation: The combination of a weakened SAH and increased stability disrupts the normal Hadley circulation, leading to anomalous subsidence over land.
- Amplifies droughts: The resulting large-scale subsidence can amplify the severity of monsoon droughts.

How aerosols get into ATAL

- Upward transport during monsoon: Strong deep convection during the monsoon season lifts aerosols from the lower atmosphere into the upper troposphere and lower stratosphere.
- Long-range transport: Aerosols like dust and black carbon from sources like East China and North India are transported to the ATAL region.
- El Niño influence: During El Niño years, atmospheric circulation can lift more aerosols from East Asia to the ATAL, increasing its intensity and impact.

Secondary air pollutants

Ground-level ozone pollution is caused by the chemical reaction of nitrogen oxides (NOx) and volatile organic compounds (VOCs) in the presence of sunlight. These precursor pollutants are released from sources like vehicle emissions, power plants, and industrial processes. The effects are negative and include respiratory problems like asthma and lung damage, as well as damage to sensitive plants and ecosystems.

Causes

- Formation Process: Ground-level ozone is a "secondary pollutant" because it is not directly emitted but forms from a chemical reaction in the atmosphere.
- Sunlight: The reaction requires sunlight, which is why ozone levels are often highest on hot, sunny days.
- Precursor Pollutants: The key ingredients are NOx and VOCs:
    - Nitrogen Oxides (NOx): Sources include vehicle exhaust, power plants, and industrial boilers.
    - Volatile Organic Compounds (VOCs): Sources include gasoline vapors, industrial processes, and solvents.
- Sources of Pollutants: Both human and natural activities release NOx and VOCs:
    - Human: Burning fossil fuels in cars and power plants, industrial processes.
    - Natural: Wildfires and vegetation (VOCs), volcanoes, and lightning strikes (NOx).

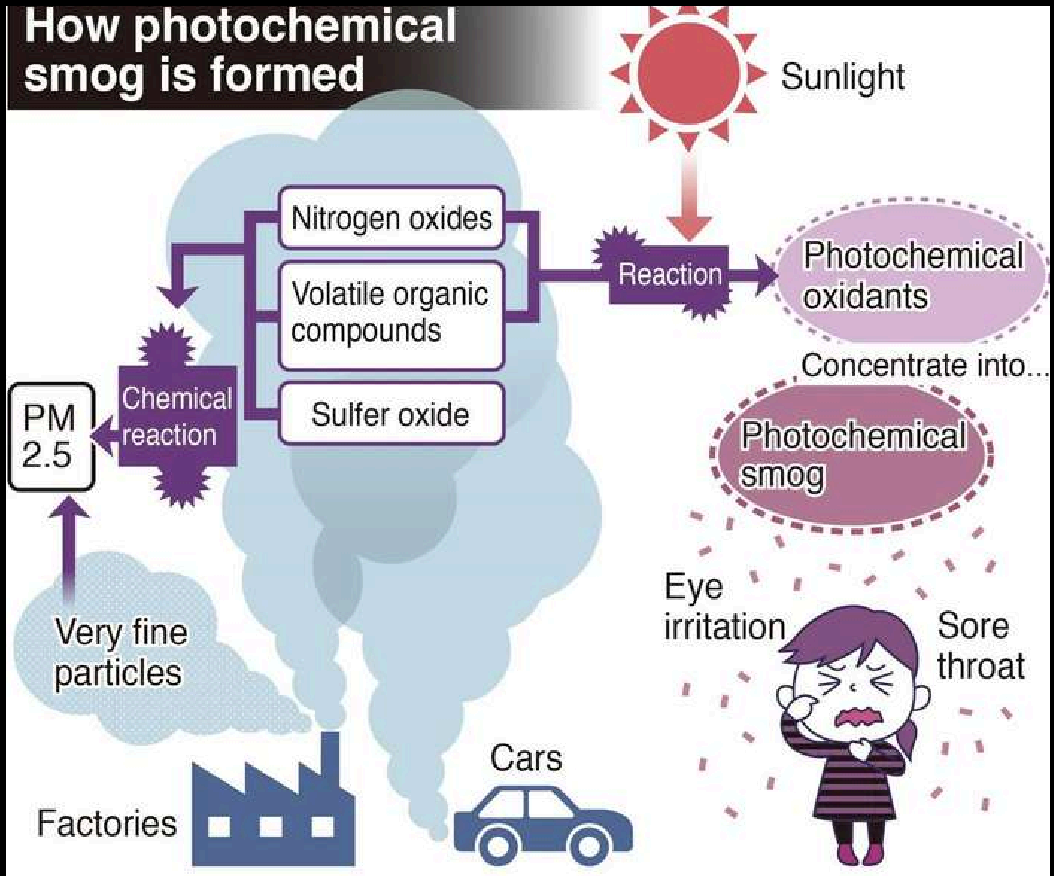
DIRECTION IAS

Effects | Health Effects:

- Irritates the lungs and airways, causing inflammation and chest pain.
- Aggravates respiratory diseases like asthma and COPD.
- Can lead to reduced lung function and permanent lung scarring with long-term exposure.

Environmental Effects:

- Damages sensitive vegetation, affecting forests, crops, and ecosystems.
- Contributes to reduced crop yields.
- Other effects:
- Acts as a greenhouse gas, contributing to climate change.



Photochemical smog: A complex mixture of pollutants, including ozone and nitrogen dioxide, that forms from the reaction of nitrogen oxides and hydrocarbons under sunlight.

Acid rain is caused by air pollution from pollutants like sulfur dioxide and nitrogen oxides

Causes of acid rain

- Human activities:Fossil fuel combustion: Burning coal, oil, and gas in power plants, factories, and vehicles releases large amounts of sulfur dioxide and nitrogen oxides .
- Industrial processes: Manufacturing and other industrial activities are significant sources of these pollutants.
- Agriculture: Livestock farming contributes to acid rain through ammonia emissions.
- Natural sources:Volcanic eruptions: Natural eruptions release sulfur dioxide into the atmosphere.Lightning: This can produce nitrogen oxides.
- Forest fires: These also contribute to the emission of these gases.

Effects of acid rain

- Damage to ecosystems:Aquatic ecosystems: Acid rain can acidify lakes and rivers, making them uninhabitable for fish and other aquatic life. It can also release toxic aluminum from the soil into the water.
- Forests: It can damage trees by stripping nutrients from the soil and making it harder for them to absorb water and nutrients.
- Soil: It can leach essential nutrients from the soil and release toxic substances.Damage to buildings and materials:Acid rain corrodes stone, marble, and metal, causing structures like buildings, monuments, and statues to deteriorate.
- Human health impacts:The sulfate and nitrate particles that form from acid rain in the atmosphere can be inhaled, leading to respiratory problems like asthma, dry cough, and throat irritation.

Peroxyacetyl nitrate (PAN) is a harmful air pollutant formed by photochemical reactions between nitrogen oxides and volatile organic compounds in smog.

Causes of PAN formation

- Photochemical reactions: PAN is a secondary pollutant, meaning it is formed in the atmosphere through chemical reactions rather than being emitted directly.
- Precursors: The key precursors are nitrogen oxides and volatile organic compounds (VOCs).
- Source of precursors: These precursors primarily come from human activities like the combustion of fossil fuels in vehicles, power plants, and other industrial processes.
- Formation process: The formation pathway involves the reaction of a peroxyacetyl radical with nitrogen dioxide . The process is driven by sunlight (photochemical), which is why PAN is a major component of photochemical smog.

Effects of PAN pollution

- Human health: PAN is a strong lachrymator, causing eye irritation at very low concentrations. It is also considered a potential mutagen and contributor to skin cancer.
- Vegetation damage: PAN is highly phytotoxic and can cause visible damage to plants, such as glazing or bronzing of leaves.
- Atmospheric transport: Due to its temperature-dependent stability, PAN can be transported long distances in cooler parts of the atmosphere. It acts as a reservoir for nitrogen oxides (NOx) and decomposes to release them in warmer environments, which can facilitate ozone formation regionally and globally.

Central Pollution Control Board is executing a nation-wide programme of ambient air quality monitoring known as National Air Quality Monitoring Programme (NAMP). The network consists of 966 operating stations in 419 cities/towns in 28 states and 7 Union Territories of the country

The objectives of the N.A.M.P. are to

- determine status and trends of ambient air quality;
- to ascertain whether the prescribed ambient air quality standards are violated;
- to Identify Non-attainment Cities; to obtain the knowledge and
- understanding necessary for developing preventive and corrective measures and to understand the natural cleansing process undergoing in the environment through pollution dilution, dispersion, wind based movement, dry deposition, precipitation and chemical transformation of pollutants generated.

Under N.A.M.P., four air pollutants viz .,

- Sulphur Dioxide (SO2),
- Oxides of Nitrogen as NO2,
- Respirable Suspended Particulate Matter (RSPM / PM10) and
- Fine Particulate Matter (PM2.5)

have been identified for regular monitoring at all the locations.

- The monitoring of meteorological parameters such as wind speed and wind direction, relative humidity (RH) and temperature were also integrated with the monitoring of air quality.
- The monitoring of pollutants is carried out for 24 hours (4-hourly sampling for gaseous pollutants, 8-hourly sampling for particulate matter and 24-hourly sampling for PM2.5) with a frequency of twice a week, to have one hundred and four (104) observations in a year.

The monitoring is being carried out with the help of

- Central Pollution Control Board;
- State Pollution Control Boards;
- Pollution Control Committees and other agencies.

CPCB co-ordinates with these agencies to ensure the uniformity, consistency of air quality data and provides technical and financial support to them for operating the monitoring stations. N.A.M.P. is being operated through various monitoring agencies. Large number of personnel and equipment are involved in the sampling, chemical analyses, data reporting etc. It increases the probability of variation and personnel biases reflecting in the data, hence it is pertinent to mention that these data be treated as indicative rather than absolute.

India's National Ambient Air Quality Standards (NAAQS), established by the Central Pollution Control Board (CPCB), define the maximum permissible levels for 12 pollutants, including PM10, PM2.5, SO_2, and NO_2, to protect public health and the environment.

The 12 pollutants regulated under India's NAAQS:

- Particulate Matter: PM10 and PM2.5
- Gases: Sulfur Dioxide , Nitrogen Dioxide, Carbon Monoxide (CO), and Ammonia Ozone
- Heavy Metals: Lead (Pb), Arsenic, and Nickel
- Organic Compounds: Benzene and Benzo-Pyrene

These standards, notified in 2009, include different limits for different areas (e.g., industrial, residential, and ecologically sensitive) and specify annual averages and 24-hour averages for various pollutants.

Key aspects of India's NAAQS Regulated pollutants: The standards regulate 12 pollutants, a significant increase from previous norms, which now includes dangerous pollutants like PM2.5, ozone, lead, and benzene.

Area-specific standards: The permissible limits for pollutants are different depending on the land use of the area.Industrial areas: Have higher permissible limits compared to residential areas.Residential, rural, and other areas: Have lower permissible limits, reflecting a focus on public health.

Ecologically sensitive areas: Have the strictest standards for some pollutants, like SO_2 and NO_2, to protect vulnerable ecosystems.Monitoring and compliance:Annual average:

These are based on a minimum of 104 measurements per year, taken twice a week.24-hour average: These standards must be met 98% of the time annually, with a 2% tolerance for exceedance but not on two consecutive days.

Pollutant	Time Weighted Average	Concentration in Ambient Air	
		Industrial, Residential, Rural, and Other Areas	Ecologically Sensitive Area (notified by Central Government)
Sulphur dioxide (SO_2), $\mu g/m^3$	Annual 24 hours	50 80	20 80
Nitrogen dioxide (NO_2), $\mu g/m^3$	Annual 24 hours	40 80	30 80
Particulate matter (< 10 µm) or PM_{10}, $\mu g/m^3$	Annual 24 hours	60 100	60 100
Particulate matter (< 2.5 µm) or $PM_{2.5}$, $\mu g/m^3$	Annual 24 hours	40 60	40 60
Ozone (O_3), $\mu g/m^3$	8 hours 1 hour	100 180	100 180
Lead (Pb), $\mu g/m^3$	Annual 24 hours	0.50 1.0	0.50 1.0
Carbon monoxide (CO), mg/m^3	8 hours 1 hour	02 04	02 04
Ammonia (NH_3), $\mu g/m^3$	Annual 24 hours	100 400	100 400
Benzene (C_6H_6), $\mu g/m^3$	Annual	05	05
Benzo(α)Pyrene (BaP) – particulate phase only, ng/m^3	Annual	01	01
Arsenic (As), ng/m^3	Annual	06	06
Nickel (Ni), ng/m^3	Annual	20	20

AIR QUALITY INDEX

Eight pollutants namely particulate matter (PM) 10, PM2.5, Ozone (O_3), Sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), lead (Pb) and ammonia (NH_3) act as major parameters in deriving the AQI of an area.

AQI is the air quality index; it gives you the index value that what is the current pollution status in the city, how polluted the air currently is. different levels of AQI symbolises different things like on prolonged exposure to ‘poor’ AQI, individuals might witness breathing problem.

SAFAR is India's System of Air Quality and Weather Forecasting and Research, a national initiative to provide real-time and forecasted air quality data for metropolitan cities. It measures various pollutants and weather parameters, presents them using a color-coded Air Quality Index (AQI), and offers health advisories for the public to help them understand and take action on air pollution.

As per **CPCB's (Central Pollution Control Board) air quality standards, AQI is categorised into six parts.** As the AQI value increases, health impacts become serious. For instance, while under satisfactory AQI, sensitive people might witness minor breathing discomfort, severe AQI may cause respiratory impact even on healthy people, and serious health issue in people with existing respiratory issues.

AIR QUALITY INDEX (AON)	CATEGORY
0-50	Good
51-100	Satisfactory
101-200	Moderate
201-300	Poor
301-400	Very Poor
401-500	Severe

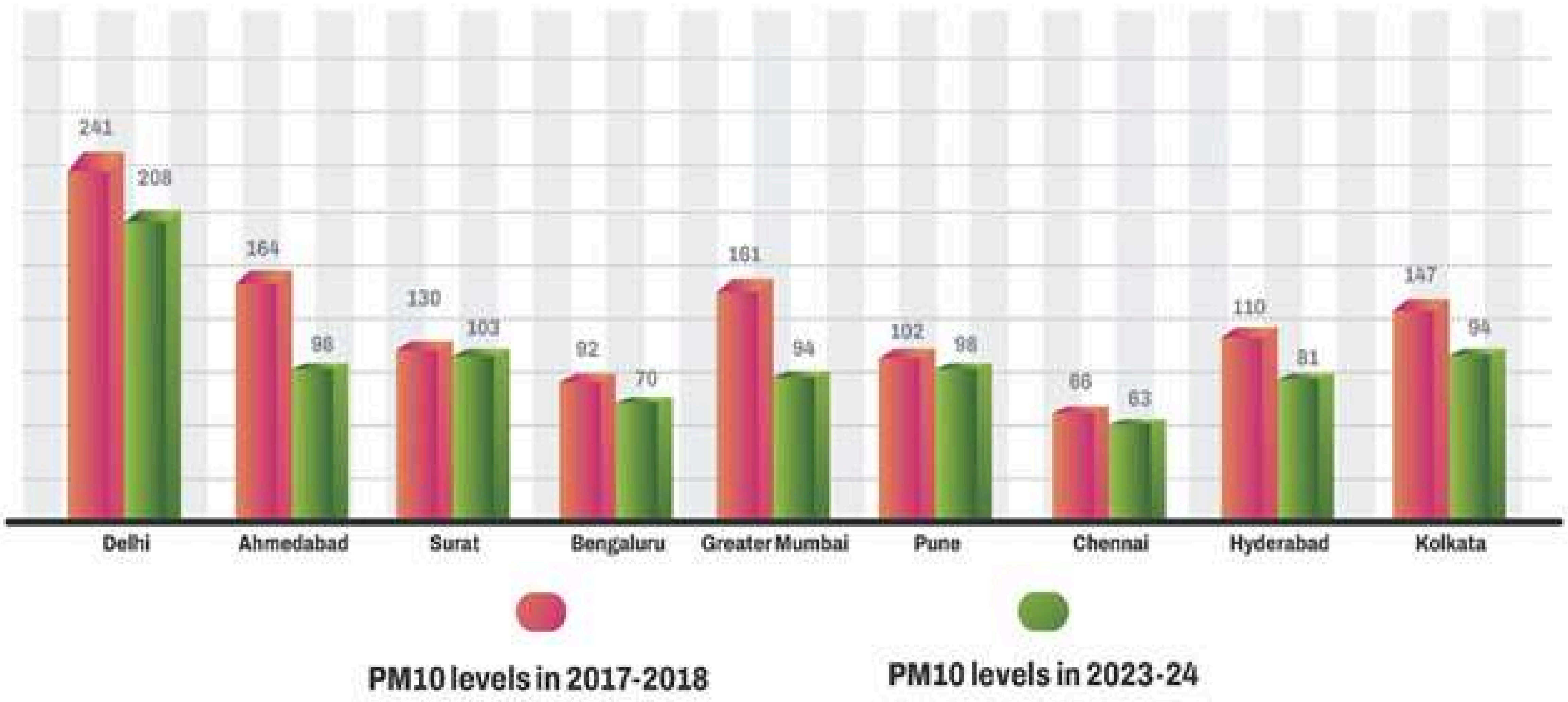
Swachh Vayu Diwas: India’s Commitment to Clean Air

- September 7 is celebrated as International Day of Clean Air for Blue Skies In line with this global movement, India celebrates Swachh Vayu Divas on the same day, reinforcing its dedication to addressing the critical issue of air pollution. National Clean Air Programme (NCAP): A national strategy to improve air quality, with targets to reduce particulate matter (PM) by 20-30% by 2024, later extended to 40% by 2026.

The themes for International Day of Clean Air for Blue Skies have been

- 2020: "Clean Air for All"
- 2021: "Healthy Air, Healthy Planet"
- 2023: "#TogetherForCleanAir"
- 2024: No specific theme stated, but focused on the health impacts of air pollution.
- 2025: "Racing for Air. Every Breath Matters."

Air Quality in terms of PM10 levels in Metro cities



Swachh Vayu Sarvekshan is structured as a rigorous, multi-tiered evaluation mechanism, founded on comprehensive due diligence under the National Clean Air Programme. Swachh Vayu Sarvekshan is conducted for 130 cities under NCAP annually to promote healthy competition among cities to take expeditious actions to improve air quality.

The following cities were conferred awards by the Minister, EF&CC:

In Category-1 (population of over 10 lakh population):

Indore secured 1st rank with score of 200 out of 200. Indore has planted over 16 lakh trees in last year, earning a Guinness World Record, and has public transport run through 120 electric buses and 150 CNG buses.

Jabalpur secured 2nd rank with score of 199 out of 200. Jabalpur has set up 11 MW waste to energy plant and developed greenery.

Agra and Surat secured 3rd rank with a score of 196 out of 200. Agra has remediated legacy waste dump site and carried out Miyawaki plantation. Surat has brought EV policy to provide incentives and tax benefits to EVs and maintains 38% green cover.

In Category – 2 (population between 3 and 10 lakh):

Amravati secured 1st rank with score of 200 out of 200. Amravati improved road infrastructure including 340 km end-to-end pavement and carried out extensive greening in 53 gardens, and converted 19 acres of barren land into dense forest.

Jhansi and Moradabad secured 2nd rank with score of 198.5 out of 200. Jhansi developed urban greening and miyawaki forests. Moradabad has worked on road infrastructure and construction and demolition waste management.

Alwar secured 3rd rank with a score of 197.6 out of 200. Alwar has remediated the legacy waste dump.

In Category- 3 (population under 3 lakh):

Dewas secured 1st rank with score of 193 out of 200. Dewas shifted industries to cleaner fuels

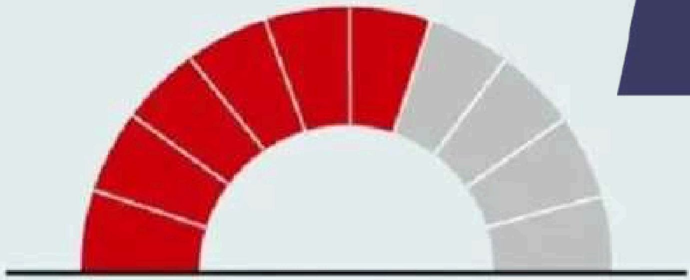
Parwanoo secured 2nd rank with score of 191.5 out of 200. Parwanoo worked on end-to-end pavement of roads

Angul secured 3rd rank with score of 191 out of 200. Angul also worked on road infrastructure and conducted public outreach activities.

Key government initiatives and policies

- National Clean Air Programme (NCAP): A national strategy to improve air quality, with targets to reduce particulate matter (PM) by 20-30% by 2024, later extended to 40% by 2026.
- Graded Response Action Plan (GRAP): A plan for Delhi-NCR that mandates specific actions based on air quality levels, ranging from restricting construction to vehicle bans.
- National Air Quality Index (AQI): Provides real-time information on air quality to the public.
- Commission for Air Quality Management (CAQM): A body for managing air quality in the National Capital Region and surrounding areas.

LATEST NEWS

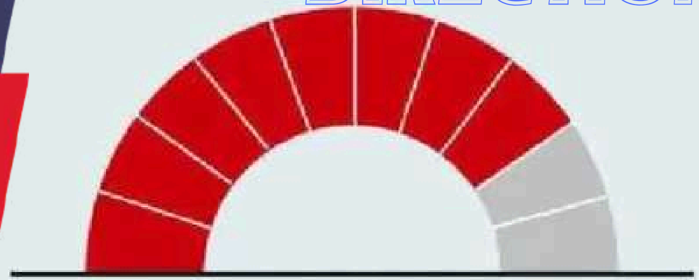


STAGE 1

(AQI 'POOR' - 201 TO 300)

Stopping all construction and demolition activities with plot size of 500 sqm or more which have not been registered on dust mitigation monitoring portals

- Mechanised sweeping, water sprinkling on roads
- Enforcing guidelines on use of anti-smog guns at construction site
- Enforcing ban on open burning of waste and PUC for vehicles
- Discoms to minimise power supply interruptions in NCR
- Encourage offices to start unified commute for employees to reduce traffic



STAGE 2

(AQI 'VERY POOR' - 301 TO 400)

Stopping use of diesel generator sets except for essential and emergency services (hospitals, railways, metro, airports, water pumping stations, 'projects of national importance')

- Not allowing coal/firewood in tandoors at hotels
- Enhance parking fees to discourage private transport
- Augment CNG/ electric

bus and metro services by procuring additional fleet and increasing the frequency of service

UPDATE

STAGE 3
(AQI 'SEVERE' - 401 TO 450)

Ban on construction and demolition activities except railway, metro, hospitals, sanitation projects etc, linear public projects like highways, roads, flyovers

- Closure of industries that have PNG supply and are not running on approved fuels. In industrial areas that don't have PNG supply, industries not running on approved fuels will operate only for five days a week
- State governments in NCR may impose restrictions on BS III petrol and BS IV diesel four-wheelers

STAGE 4
(AQI 'SEVERE +' - MORE THAN 450)

State govts can consider closing schools; odd-even vehicle system; decide on letting public, pvt offices to work on 50% strength, rest to work from home

- Stop entry of truck traffic (except essentials, CNG, e-trucks). Ban on plying of Delhi-registered diesel medium- and heavy-goods vehicles, except essentials
- Ban on plying of four-wheeler diesel vehicles, except BS-VI and vehicles for essential services
- Ban C&D activities in linear public projects such as highways, roads, flyovers

(Actions under Stages II, III and IV will be invoked three days in advance of AQI reaching the projected level)

Transportation and fuel measures

DIRECTION IAS

- **Stricter Vehicle Emission Standards:** Leapfrogging from BS-IV to BS-VI norms nationwide since April 2020.
- **Promotion of Electric and Alternative Vehicles:** Incentivizing electric vehicles through the FAME scheme (Faster Adoption and Manufacturing of Electric Vehicles) and expanding public transport like Metro rail and high-capacity buses.
- **Cleaner Fuels:** Promotion of cleaner fuels like Compressed Natural Gas (CNG) and LPG, along with ethanol blending in petrol.
- **Scrappage Policy:** Encouraging the scrapping of old, polluting vehicles.
- **Mandatory PUC Certification:** Ensuring vehicles have a valid Pollution Under Control certificate.

BS IV vs BS VI

Vehicle	Sulphur content (part per million)	
	BS IV	BS VI
Diesel Vehicle	50	10
Petrol Vehicle	30	10

- Oxides of Nitrogen down by 68 per cent in BS VI norms
- Particulate levels down by 82 per cent in BS VI norms

Industrial Emission Norms: Revision of industrial emission standards and installation of online continuous monitoring devices in major industries.

- Construction and Demolition Waste Management Rules: Introduced rules for managing construction and demolition waste, including dust mitigation measures like water sprinkling and mechanical sweeping.
- Brick Kilns: Mandating the shift of brick kilns to "zig-zag" technology.
- Waste Management: Implementation of rules for solid waste management to control open burning of waste.

Other initiatives

- Energy Efficiency: Promoting energy-efficient appliances and energy conservation practices.
- Greening: Developing green corridors and urban green belts to absorb pollutants.
- Public Awareness: Running public awareness programs and using platforms like the SAFAR (System of Air Quality and Weather Forecasting and Research) portal.
- Household Energy: Pradhan Mantri Ujjwala Yojana promotes the use of clean cooking fuel (LPG) instead of firewood.

Zig-zag technology arranges bricks to create a zigzag path for hot air and combustion gases, which improves heat transfer and combustion efficiency. This leads to reduced fuel consumption and lower emissions of particulate matter and other pollutants.