Air quality monitoring in Delhi

Prelims: *Current events of national and international importance*

Why in News?

The Supreme Court recently asked authorities to explain the equipment used in Delhi air-quality monitoring stations and whether it is suited to the city's conditions.

- **Monitoring Stations -** Delhi's network comprises 40 Continuous Ambient Air Quality Monitoring Stations (CAAQMS).
- They operate under Central Pollution Control Board (CPCB) guidelines issued in 2012.
- **Tracking Pollutants -** Each station must track 8 pollutants - PM2.5, PM10, nitrogen dioxide, sulphur dioxide, carbon monoxide, ozone, ammonia, and lead.
- **Monitoring Methods -** Particulate matter is measured using ***Beta Attenuation Monitors (BAM),*** which rely on the beta ray attenuation principle.
- A small Carbon-14 or Krypton-85 source emits beta rays through a clean patch of filter tape.
- After air is drawn through and dust collects on the tape, the instrument re-measures the spot.
- Fewer beta rays pass through, and the decline in signal is used to calculate PM2.5 and PM10 concentrations.
- For gaseous pollutants, stations mainly use optical methods because gases absorb or emit specific wavelengths of light.
- Sulphur dioxide is measured by UV fluorescence, which detects the weak glow SO_2 emits under ultraviolet light.
- Ozone is measured by UV photometry, which tracks how much UV light it absorbs.
- Carbon monoxide is measured using non-dispersive infrared (NDIR) absorption, based on how much infrared light CO absorbs.
- Nitrogen oxides are measured through chemiluminescence, where

instruments detect the faint light produced when the gases react with ozone inside the analyzer.
- Ammonia is measured using optical spectroscopy based on its characteristic absorption of light.
- These methods are approved under the National Ambient Air Quality Standards (NAAQS) of 2009 to ensure comparable data across India.

Recent findings of the study

- Recent scientific studies have examined the reliability of particulate measurements in Delhi, including a 2021 analysis of BAM performance under the city's extreme meteorological conditions.
- Researchers found that biases in beta gauge readings vary with ambient high RH, particle mass loading, boundary layer height and ventilation coefficient.
- When relative humidity exceeded 60%, PM2.5 measurements by the beta gauge method show more deviation, leading to high mass concentration, with overestimation rising in winter and post-monsoon periods.
- The study reported that more than 30% overestimation was observed especially when RH reaches over 60%.
- During high-pollution episodes, the bias could further increase by a factor up to ~5 when particle mass loading also becomes high."

Reference

The Indian Express | Air Quality Monitor