Air pollutants are added in the atmosphere from variety of sources that change the composition of atmosphere and affect the biotic environment.

The concentration of air pollutants depend not only on the quantities that are emitted from air pollution sources but also on the ability of the atmosphere to either absorb or disperse these emissions.

The air pollution concentration vary spatially and temporarily causing the air pollution pattern to change with different locations and time due to changes in meteorological and topographical condition.

An **air quality index** (AQI) is a number used by government agencies to communicate to the public how polluted the air currently is or how polluted it is forecast to become.

As the AQI increases, an increasingly large percentage of the population is likely to experience increasingly severe adverse health effects.

The AQI is an index for reporting daily air quality. It tells you how clean or unhealthy your air is, and what associated health effects might be a concern.

The AQI focuses on health effects you may experience within a few hours or days after breathing unhealthy air.

Different countries have their own air quality indices, corresponding to different national air quality standards. Some of these are the Air Quality Health Index (Canada), the Air Pollution Index (Malaysia), and the Pollutant Standards Index (Singapore).

Canada,HonKong,UK

Low **(1–3)** Moderate **(4–6)** High **(7–10)** Very high **(above 10)**

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

- **The six levels of health concern and what they mean are:**
- "Good" AQI is 0 to 50. ...
- "Moderate" AQI is 51 to 100. ...
- "Unhealthy for Sensitive Groups" AQI is 101 to 150. ...
- "Unhealthy" AQI is 151 to 200. ...
- "Very Unhealthy" AQI is 201 to 300. ...
- "Hazardous" AQI greater than 300.

- On a day when the AQI is predicted to be elevated due to fine particle pollution, an agency or public health organization might:
- Advise sensitive groups, such as the elderly, children, and those with respiratory or cardiovascular problems to avoid outdoor exertion.
- Declare an "action day" to encourage voluntary measures to reduce air emissions, such as using public transportation.
- Recommend the use of masks to keep fine particles from entering the lungs.

Units of measurement. Air quality measurement are commonly reported in terms of: **micrograms** per cubic **meter** (**µg/m3**) parts per million (**ppm**) or parts per billion (**ppb**)

Public Availability of the AQI

Real time monitoring data and forecasts of air quality that are color-coded in terms of the air quality index are available from EPA's Air Now web site. Historical air monitoring data including AQI charts and maps are available at EPA's Air Data website. Detailed map about current AQI level and its two day forecast is available from Aero state web site.

The **Environmental Protection Agency** (**EPA**) is an independent agency of the United States federal government for environmental protection. President Richard Nixon proposed the establishment of EPA on July 9, 1970 and it began operation on December 2, 1970, after Nixon signed an executive order.

Environmental Protection Agency (EPA) is a science leader in the development and improvement of instruments, methods, techniques and other tools to measure and **monitor air** quality and evaluate **air** emissions to protect public health and the environment from **air pollution**.

	Focus area	Usage
Ambient monitoring	the whole city or state or country	Data is used for long-term spatial and temporal trend analysis; can be used to determine the merits and the de-merits of an intervention over time
On-road(mobile) monitoring	confined to roads and their immediate vicinity	Data is used for understanding pollution exposure during commute; specially to understand the acute health impacts of being exposed to augmented pollution levels on the roads
Satellite monitoring	the whole city or state or country	Data is used mostly for annual scale pollution trend analysis
Emissions monitoring	a specific source	Data is used to establish the emission rate by source, by fuel, by technology, and by usage

Ambient air monitoring is an integral part of an effective air quality management system.

- Most of the ambient air monitoring networks supporting air quality management are designed and operated by tribal, state, or local governments. EPA develops requirements and guidance for the design and operation of these networks. The requirements are in the Code of Federal Regulations under Title 40. Requirements related to methods are in the appendices to Part 50 and in Part 53. Network requirements are in Part 58 – Ambient Air Quality Surveillance.
- EPA's Ambient Monitoring Technology Information Center (AMTIC) contains technical information on monitoring programs, including the networks of state or local air monitoring stations (SLAMS), monitoring methods, and quality assurance and control procedures.
- The Air Quality System is a national repository of ambient air pollution data collected by EPA, state, local, and tribal air pollution control agencies. It also contains meteorological data, descriptive information about each monitoring station (including its geographic location and its operator), and data quality assurance/quality control information.
- EPA's Air Data website provides public access to air quality data collected at outdoor monitors, including the ability to download data, create summary reports, visualize the data, and access an interactive map of monitors.

- assess the extent of pollution;
- provide air pollution data to the general public in a timely manner;
- support implementation of air quality goals or standards;
- evaluate the effectiveness of emissions control strategies;
- provide information on air quality trends;
- provide data for the evaluation of air quality models; and
- support research (e.g., long-term studies of the health effects of air pollution).

Clean **Air** Act requires EPA to set National Ambient **Air Quality Standards** (NAAQS) NAAQS are currently set for carbon monoxide, lead, ground-level ozone, nitrogen dioxide, particulate matter, and sulfur dioxide. for six common **air pollutants** (also known as "criteria **air pollutants**.

There are six AQI categories, namely Good, Satisfactory, Moderately polluted, Poor, Very Poor, and Severe. The proposed AQI will consider eight pollutants (PM_{10}, $PM_{2.5}$, NO_2, SO_2, CO, O_3, NH_3, and Pb) for which short-term (up to 24-hourly averaging period) National Ambient Air Quality Standards are prescribed.

- Air pollution in India is mainly caused from three sources namely vehicles, industrial and domestic sources.
- Major Cities: The problem of air pollution is in major cities where the prominent source of air pollution is vehicles and small/medium scale industries. These cities include Delhi, Kolkata, Mumbai, Chennai, Ahmedabad, Bangalore, Hyderabad, Pune, Kanpur etc.

National Air Monitoring Programme (N.A.M.P.)

Central Pollution Control Board initiated National Ambient Air Quality Monitoring (NAAQM) programme in the year 1984 with 7 stations at Agra and Anpara. Subsequently the programme was renamed as National Air Monitoring Programme (N.A.M.P.).

The National Air Quality Index (AQI) was launched in New Delhi on September 17, 2014 under the Swachh Bharat Abhiyan.

The Central Pollution Control Board along with State Pollution Control Boards has been operating National Air Monitoring Program (NAMP) covering 240 cities of the country having more than 342 monitoring stations. While the earlier measuring index was limited to three indicators, the new index measures eight parameters. The continuous monitoring systems that provide data on near real-time basis are installed in New Delhi, Mumbai, Pune and Ahmedabad.

Air pollution sensors are devices that detect and monitor the presence of air pollution in the surrounding area. They can be used for both indoor and outdoor environments. These sensors can be built at home, or bought from certain manufactures.

Although there are various types of air pollution sensors, and some are specialized in certain aspects, the majority focuses on five components: ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrous oxide. The sensors were very expensive in the past, but with technological advancements these sensors are becoming more affordable and more widespread throughout the population. These sensors can help serve many purposes and help bring attention to environmental issues beyond the scope of the human eye.

A Typical Regulatory Monitor

- Produces data of known value and highly reliable
- Stationary- cannot be easily relocated
- Instruments are often large and require a building to support their operation
- Expensive to purchase and operate (typically > $20K each)
- Requires frequent visits by highly trained staff to check on their operation
- Often operate for 10+ years before needing to be replaced

A Typical Low Cost Monitor

- Inexpensive to purchase
- Highly portable and easy to operate (often mobile)
- Requires little or no training to start collecting data
- Inexpensive to operate (replace or recharge batteries)
- Lifetime of service not expected to exceed 1-2 years

Metal Oxide (MOS), Electrochemical and Light Scattering Sensors

•The most widely available of all sensor types
•Inexpensive •Available in a wide array of
pollutants
•Often not specific to any one pollutant
•Co-factors often influence their output
•Response relational to some given parameter

•Light scattering sensors dominate market
•Cost varies
•Sensitive to light
•Size definition varies widely
•Unit output definition varies widely
•Aerosol composition influences response
•Not true mass measurement

Example - PM Sensors

DYLOS

SPECK

MET ONE

SHINYEI

AIRBEAM

TZOA

Example- Gas Sensors

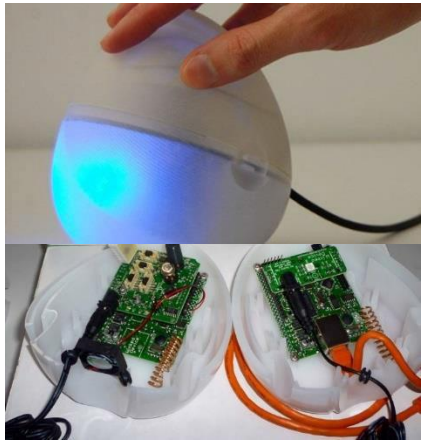
SENSARIS

AIR CASTING

CAIRCLIP

AEROQUAL

AQ EGG



NODE

Example- MultiPollutant Stations

ELM

HAZ-SCANNER

AQ MESH

Weather. Many devices are temperature and/or relative humidity (RH) sensitive. Most sensors are not weather protected

Battery life. Wide range in operational ranges exist

Orientation. Some devices require a very specific orientation

Data storage/transmission. WiFi, data card, cellular, tablet, PC. Lots of variants and often problematic

Lack of sensitivity. Failure to measure at ambient levels

Interferences. Gas sensors often respond to “other” pollutants