Monitoring of Air Pollutants

AIR SAMPLING

- **Air pollution sampling** : Related to analysis of pollutants in a given volume of air.
- **Air sampling:** Capturing the contaminant from a known volume of **air**, measuring the amount of contaminant captured, and expressing it as a concentration
- The air is passed through a filter medium (normally a paper for solid & liquid contaminants and a sorbent for gases).
- The volume of air is measured against the amount of contaminant captured. This gives the concentration, which is expressed either as milligrams per cubic metre (mg/m3) or parts per million (ppm).
- The volume of air is calculated by multiplying the flow rate through the filter medium by the time in minutes.

Monitoring of Air Pollution

- Monitoring is done to keep a track on quality of air with a view to collect information & improve it.
- The best indicators are – SO_2, NO_2, smoke & suspended particles.
- These are monitored on a daily basis and the results are collected by a central agency

Air Quality Index (AQI)

- The AQI is a tool that simplifies reporting air quality to the general public. It has been adopted by the USEPA and is used by many cities to report to the public an overall assessment of a given day's air quality.
- The AQI converts concentration of 5 criteria pollutants (PM, O3, CO, SO2, NO2) into a single index (number) between 0 and 500 and assigns a descriptive term (e.g. good, moderate) to that value.

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
When the AQI is in this range:	...air quality conditions are:	...as symbolized by this color:
0 to 50	Good	Green
51-100	Moderate	Yellow
101-150	Unhealthy for Sensitive Groups	Orange
151-200	Unhealthy	Red
201-300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Air Quality Index (AQI)

- Each pollutant concentration is converted into an AQI number using the method developed by USEPA. The highest AQI number is the AQI value of the day.
- For example: On a particular day, if a certain area has an AQI value of 120 for PM2.5 and 88 for SO2, then the AQI for that particular day is 120 and the critical pollutant is PM2.5.

Table: Breakpoint concentration of criteria pollutants and AQI categories

O_3 (ppb)	O_3 (ppb)	$PM_{2.5}$ ($\mu g/m^3$)	PM_{10} ($\mu g/m^3$)	CO (ppm)	SO_2 (ppb)	NO_2 (ppb)	AQI
C_{low} - C_{high} (avg)	C_{low} - C_{high} (avg)	C_{low}- C_{high} (avg)	C_{low} - C_{high} (avg)	C_{low} - C_{high} (avg)	C_{low} - C_{high} (avg)	C_{low} - C_{high} (avg)	I_{low} - I_{high}
0-54 (8-hr)	-	0.0-12.0 (24-hr)	0-54 (24-hr)	0.0-4.4 (8-hr)	0-35 (1-hr)	0-53 (1-hr)	0-50
55-70 (8-hr)	-	12.1-35.4 (24-hr)	55-154 (24-hr)	4.5-9.4 (8-hr)	36-75 (1-hr)	54-100 (1-hr)	51-100
71-85 (8-hr)	125-164 (1-hr)	35.5-55.4 (24-hr)	155-254 (24-hr)	9.5-12.4 (8-hr)	76-185 (1-hr)	101-360 (1-hr)	101-150
86-105 (8-hr)	165-204 (1-hr)	55.5-150.4 (24-hr)	255-354 (24-hr)	12.5-15.4 (8-hr)	186-304 (1-hr)	361-649 (1-hr)	151-200
106–200 (8-hr)	205–404 (1-hr)	150.5–250.4 (24-hr)	355–424 (24-hr)	15.5–30.4 (8-hr)	305–604 (24-hr)	650–1249 (1-hr)	201–300
-	405-504 (1-hr)	250.5-350.4 (24-hr)	425-504 (24-hr)	30.5-40.4 (8-hr)	605-804 (24-hr)	1250-1649 (1-hr)	301-400
-	505-604 (1-hr)	350.5-500.4 (24-hr)	505-604 (24-hr)	40.5-50.4 (8-hr)	805-1004 (24-hr)	1650-2049 (1-hr)	401-500

AQI for a particular pollutant, I_p

$$I_p = \frac{I_{Hi} - I_{Lo}}{BP_{Hi} - BP_{Lo}}(C_p - BP_{Lo}) + I_{Lo}$$

I_p = the index value for pollutant p
C_p = the concentration of pollutant p
BP_{Hi} = the breakpoint $\geq C_p$
BP_{Lo} = the breakpoint $\leq C_p$
I_{Hi} = the AQI value corresponding to BP_{Hi}
I_{Lo} = the AQI value corresponding to BP_{Lo}

Example: Suppose a monitor records a 24-hour average fine particle (PM2.5) concentration of 26.4 μg/m³. The equation above results in an AQI of:

$$\frac{100 - 51}{35.4 - 12.1}(26.4 - 12.1) + 51 = 81.073$$

which rounds to index value of 81, corresponding to air quality in the "Moderate" range.

Problem on AQI

On Jan 10, 2020, the following air quality data have been recorded at the CAMs in Dhaka. Calculate and report AQI for 10/01/2020.

- PM2.5 = 190 $\mu g/m^3$ (24 hr)
- PM10 = 280 $\mu g/m^3$ (24 hr)
- O_3 = 0.095 ppm (8-hr)


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