AIR Pollution Lecture 2

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1. To study environmental engineering you should have three qualities

1.1 Quantification

When we say Air is polluted or water is polluted, you should know what is the quantity of pollution. There should be a quantity which can be compared to some standard value and comment on whether the air/water is polluted or not.

1.2 Library work

It refers to reading the literature of the subject. Go through all the research that has been done on the subject matter and acquire all the available knowledge.

1.3 Apprenticeship

Approach someone with good knowledge about the subject and ask for some project. With this, you will gain some practical experience.

2. General perception regarding air pollution

2.1 What people think as a criteria of air pollution

2.1.1 Smell

Bad smell or smell of smoke.

2.1.2 Vision

If there is smog outside, check whether you feel irritation in your eyes.

But, unfortunately, the above is not a method to quantify air pollution, as we need a comparable value. Smell or vision needs to be quantified: how bad is the smell? How blurred is the vision? It may even be possible that the smell and vision are perfectly good, but still, the air is polluted, so it is not a very good measure of air pollution.

Clean air, as we learned in high school, is a mixture of $N_2 - 78\%$, $O_2 - 21\%$, and 1% of other gases. CO_2 is about 340 PPM or 0.034% of air, but as of 2022, it has risen to 420 PPM. Unlike general perception

CO_2 is not considered a major air pollutant.If the earth was an apple, the atmosphere is the skin of the apple (important).

3. Factors Affecting Air Quality Management

3.1 Lifecycle/statistics

Earth is a sink for air pollutants, but its capacity to absorb pollutants depends on the following factors: feasibility (thermodynamics of the surroundings like temperature) and proximity (like you cannot expect the same level of pollution in Delhi and Mumbai as Mumbai is closer to the sea).

3.2 Characteristic time

Some pollutants remain for a longer time in the atmosphere. Even though the earth has the capacity to completely sink a certain pollutant, the pollutant can still produce harmful effects if it remains in the atmosphere for a longer time.

3.3 Scale

Now here comes a matter of perspective. How much scale are you looking at? If it's a local area, country, or the whole world, like you cannot comment on global warming looking at the level of CO_2 in Delhi. If the earth was an apple, the atmosphere is the skin of the apple (**important**).

4. National Ambient Air Quality Standards (NAAQS) - It provides data for the safe level of air pollution. It is revised on a timely basis.

Why does it need revision on a timely basis? (**important**) Because as soon as we reach one level of air pollution control, we target for more air control. If 50 PPM of SO_2 is considered safe now, once we reach that goal, we tend to target a concentration lower than 50 PPM.

Here is a chart attached released by NAAQS. Have a look at it. It provides the safer level for various pollutants at a daily and yearly level.

Revised National Ambient Air Quality Standards (NAAQS)
[NAAQS Notification dated 18th November, 2009]

S. No.	Pollutants	Time Weighted Average	Concentration in Ambient Air: Industrial, Residential, Rural and other Areas	Concentration in Ambient Air: Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
1	Sulphur Dioxide (SO_2), µg/m^3	Annual*	50	20	1. Improved West and Gaeke 2. Ultraviolet Fluorescence
		24 Hours**	80	80	
2	Nitrogen Dioxide (NO_2), µg/m^3	Annual*	40	30	1. Modified Jacob & Hochheiser 2. Chemiluminescence
		24 Hours**	80	80	
3	Particulate Matter (Size <10µm) or PM_{10} µg/m^3	Annual*	60	60	1. Gravimetric 2. TEOM 3. Beta attenuation
		24 Hours**	100	100	
4	Particulate Matter (Size <2.5 µm) or $PM_{2.5}$ µg/m^3	Annual*	40	40	1. Gravimetric 2. TEOM 3. Beta attenuation
		24 Hours **	60	60	
5	Ozone (O_3), µg/m^3	8 hours**	100	100	1. UV photometric 2. Chemiluminescence 3. Chemical Method
		1 hours **	180	180	
6	Lead (Pb), µg/m^3	Annual *	0.50	0.50	1. AAS/ICP Method after sampling using EPM 2000 or equivalent filter paper 2. ED-XRF using Teflon filter
		24 Hour**	1.0	1.0	
7	Carbon Monoxide (CO),	8 Hours **	02	02	Non dispersive Infra Red (NDIR)

https://cpcb.nic.in/upload/NAAQS_2019.pdf

Figure 1: acceptable level for air pollutants in μg/m^3

If you carefully look at the above table, you shall notice that the values are given in . Let's take the example of SO_2. The 24-hour safe value is 80μg/m^3. The AC's in LHC release SO_2. Can you estimate the amount of SO_2 that can be considered safe in the LHC? Of course, but we will need data for the volume of the LHC. You need proper estimates to quantify the volume of LHC.