A Case Study on Atmospheric Pollution over Mumbai - A West Coastal Mega City in India

INTRODUCTION
Air pollutants in mega cities arise from a wide variety of sources although they are mainly a result of combustion processes. Today, the largest source of pollution in most urban areas is motor vehicles, and to a lesser extent industry. Traffic-generated pollutants include nitrogen oxides, carbon monoxide, volatile organic compounds and particulates. On warm summer days the strong sunlight leads to a buildup of ozone through the oxidation of volatile organic compounds (VOCs) such as benzene in the presence of nitrogen oxides. However, due to the special atmospheric chemistry of ground level ozone, levels are very often lower in urban areas than in the countryside.

GEOGRAPHICAL FEATURES OF MUMBAI
Mumbai situated in west coast of India has been a major center of industrial and economic activities. Over the last twenty years the city has witnessed rapid urbanization and increased industrial activity and massive growth in population. Figure-1 shows the annual average concentrations of SO2, NO2, and SPM from 2000 to 2004. Data has been collected from Parel (Industrial), Bandra (Residential) and Kalbadevi (Residential). The concentration levels of SO2 (6µgm-3 to 13.30µgm-3) and NO2 (17.4µgm-3 to 34.10µgm-3) at all locations in Mumbai are generally concentrated in and around urban areas, the outdoor urban pollution levels are far higher than in the rural areas2,4. Some of the gases mentioned below can seriously affect the health of the population and should be given due attention by the concerned authorities.

Oxides of nitrogen
This gas can make children susceptible to respiratory diseases in the winters. Carbon monoxide CO (carbon monoxide) combines with hemoglobin to lessen the amount of oxygen that enters our blood through our lungs. The binding with other haeme proteins causes changes in the function of the affected organs such as the brain and the cardiovascular system, and also the developing foetus. It can impair our concentration, slow our reflexes, and make us confused and sleepy.

Sulphur dioxide
SO2 (Sulphur dioxide) in the air is caused due to the rise in combustion of fossil fuels. It can oxidize and form Sulphuric acid mist. SO2 in the air leads to diseases of the lung and other lung disorders such as wheezing and shortness of breath. Long-term effects are more difficult to ascertain as
SO2 exposure is often combined with that of SPM.

**Suspended particulate matter (SPM)**

Suspended matter consists of dust, fumes, mist and smoke. The main chemical component of SPM that is of major concern is lead, others being nickel, arsenic, and those present in diesel exhaust\(^6,9\). These particles when breathed in, lodge in our lung tissues and cause lung damage and respiratory problems\(^6,9\). The importance of SPM as a major pollutant needs special emphasis as a) it affects more people globally than any other pollutant on a continuing basis; b) there is more monitoring data available on this than any other pollutant; and c) more epidemiological evidence has been collected on the exposure to this than to any other pollutant.

**DATA BASE:**

The data is collected from Central Pollution Control Board (CPCB) New Delhi, for the period from 2000-2004 in industrial and residential areas for the selected west coastal Mega City- MUMBAI.

**ANALYSIS AND RESULTS:**

The concentration of SO\(_2\), NO\(_2\) and SPM in Mumbai are analyzed from 2000 to 2004. The pollution levels in this mega city of Southern India have been exceeded the WHO air quality guidelines\(^3\). The data is collected for industrial and a residential area at different locations in the Mumbai city is shown in Table 1 and National Ambient Air Quality Standards (NAAQS) of SO\(_2\), NO\(_2\) and SPM are shown in Table 2. Behavior of SO\(_2\), NO\(_2\) and SPM in the selected Mumbai mega city are discussed.

**CONCLUSIONS:**

The analysis of data collected from CPCB, Mumbai during 2000 to 2004 in shows that the concentration levels have been increased from 2000 to 2004 due to dense population and rapid industrialization. Here industries, automobiles, domestic fuel consumption and the use of domestic appliances contribute to the emissions while gases from garbage dumps contaminate the air. Due to increase in pollutants the temperatures inside the cities are higher around 40° C to 60°C compared to the surrounding rural areas. Hence Government has to take up some severe precautions to bring down the concentration of pollutants and reduce the use of energy consumable goods.

**REFERENCE**

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**Table 1:** Data collected locations in Mumbai mega city

| Pollution Level | Industrial |
|-----------------|------------|
| S02 & NO2 |
| Low (L) | 0-40 |
| Moderate (M) | 40-80 |
| High (H) | 80-120 |
| Critical (C) | >120 |

| SPM |
| Low (L) | 0-180 |
| Moderate (M) | 180-360 |
| High (H) | 360-540 |
| Critical (C) | >540 |

**Table 2:** National Ambient Air Quality Standards

| Year | SO2 (µg/m\(^3\)) |
|------|------------------|
| 2000 | 5 10 15 20 25 30 35 40 45 50 |
| 2001 | 5 10 15 20 25 30 35 40 45 50 |
| 2002 | 5 10 15 20 25 30 35 40 45 50 |
| 2003 | 5 10 15 20 25 30 35 40 45 50 |
| 2004 | 5 10 15 20 25 30 35 40 45 50 |

| Year | NO2 (µg/m\(^3\)) |
|------|------------------|
| 2000 | 0 100 200 300 400 |
| 2001 | 0 100 200 300 400 |
| 2002 | 0 100 200 300 400 |
| 2003 | 0 100 200 300 400 |
| 2004 | 0 100 200 300 400 |

| Year | SPM (µg/m\(^3\)) |
|------|------------------|
| 2000 | 0 100 200 300 400 |
| 2001 | 0 100 200 300 400 |
| 2002 | 0 100 200 300 400 |
| 2003 | 0 100 200 300 400 |
| 2004 | 0 100 200 300 400 |

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**Figure:** Concentration of SO\(_2\), NO\(_2\) and SPM from 2000-2004 of MUMBAI Coastal mega city in India