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The Impact of Air Pollution in Industrial Area in Durgapur Region West Bengal, India

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Abstract
Air is the most critical natural resource for all human activities. It is required for practically all developmental activities, including power production, agriculture, cooking, and all manufacturing processes. Indeed, the quantity of air required for respiration is far less than that required for other activities. Numerous components of air, most notably nitrogen (N2), carbon dioxide (CO2), oxygen (O2), and water vapour, are the primary elements of air related with biological processes. In India, like in many other industrialized and developing nations, the primary sources of air pollution are factories, thermal power plants, and vehicular emissions. Let us have a look at these sources.

Introduction

Air pollution is a major issue on a global scale. The issue of air pollution is significant and severe because of human activity. Industrial growth is critical for the economic development of any nation, since it maximizes the utilization of natural resources. In India, fast industrialization, urbanization, and population increase have put severe strain on the country's infrastructure and natural resources.

While growing industrialization and urbanization are producing major air pollution problems on the one hand, the demand on natural resources is impeding rural India's development on the other. While industrialisation has been critical to economic prosperity, it has come at a cost to the environment. Not only does industrial pollution endanger public health, it also consumes a significant amount of India's gross domestic product in the name of pollution abatement. Thus, the country's urgent need for avoiding and regulating air pollution is critical, which can be accomplished only via the effective and severe enforcement of environmental legislation. The fundamentals of environmental law were only recently acknowledged globally.

Sources of Air Pollutants

Numerous air pollutants exist naturally in the atmosphere in the form of gases, mists, and particles as background concentrations resulting from a variety of natural sources. Natural amounts of air contaminants are often non-harmful and cause no global issues. However, high amounts in concentrated regions may result in serious air pollution concerns.

Back ground concentration of some important air pollutants Swamp Gas:
Organic matter decomposition creates methane as swamp gas, which amounts to roughly 1600 million tons per year. Additionally, H2S is created in salt marshes during the anaerobic reduction of sulphate.

Dust Storms: Each year, wind circulation is projected to generate 30 million tons of dust.

Forest Fires: Forest and prairie fires emit massive amounts of smoke and other pollutants and are a worldwide occurrence.

Volcanoes: Volcanic eruptions produce a large amount of solid matter, gases such as SO2, ash, and heat energy.

Sea Spray: Is something that happens all the time and is one of the main sources of particulate pollution. Most sea spray comes from droplets of ocean water that are pushed into the water and evaporate, leaving behind the salts. These salt particles travel across the land masses near the coast and cause a lot of corrosion.

Plant Products: Pollen grains can cause a lot of problems in some places because they often cause allergic reactions. It also evaporates plant products with low vapour pressure like terpenes and resins into the air, which makes the air smell bad. Nearly 170 million tons of terpenes are thought to be made by the plant species every year. Molds, yeasts, hair, fur, and other small things in the air may also be able to make the air dirty.

Study Area
This Indian state is in the east, next to the Bay of Bengal. It is called West Bengal. This state in India has more than 91 million people and is the fourth most populous. It is also the fourteenth-largest state by area in the country. It has an area of 88,752 km2 (34,267 sq miles), making it the eighth-most populous country subdivision in the world. Part of the Bengal region of the Indian subcontinent, Bangladesh is to the east, and Nepal and Bhutan are to the north. It is part of the Bengal region. It also borders the Indian states of Odisha, Jharkhand, Bihar, Sikkim, and Assam, which are all in the same country. The state capital is Kolkata, which is the third-largest metropolis in India and the seventh-largest city in the country in terms of people. The Darjeeling Himalayan hill region, the Ganges delta, the Rarh region, and the Sundarbans are all in West Bengal, which is made up of these four places. The Bengalis are the state's main ethnic group, with Bengali Hindus making up the majority of people.

Methodology
The study is based on both primary and secondary data. This is how it works: People in West Bengal, India, used a method called "purposive sampling" to get the primary data. Before the survey, people from each region were contacted by panchayat officials and people from their area. All of them helped to get the right data from the different regions by having people who knew the area act as escorts. With the help of both a structured questionnaire and

participatory rural appraisal (PRA), we also learned a lot (informal discussion with the senior citizens of the villages, transects and so on).

For each region, two panchayats had been chosen to serve. One village was chosen for each panchayat, and from each village, except the pure-urban one, 25 households were chosen for a sample study by using a convenient sampling method, as shown in the figure. In this way, 50 sample-households were chosen for each region. For the pure industrial area, we have chosen 100 homes because the density of people there is higher than in the other three regions. The villages were chosen because they were the ones that were the most polluted by industrial waste. In total, 250 households in four different areas were looked at for the study, so it looked at all of them.

Secondary data that was important for the study came from different bulletins, articles, and magazines from Durgapur-Asansol, the central pollution control board (CPCB), and the comprehensive environmental pollution index (CEPI) in the state of West Bengal. Besides, data about industrial pollution in the area where the survey was done was also taken from a website that was available.

Statistical Tools

Each response on a Likert item is added up and put on a scale called the Likert scale. A likert item is just a statement that the respondent is asked to rate based on any kind of subjective or objective criteria. Most often, the level of agreement or disagreement is measured. Usually, three or five ordered response levels are used, but many statisticians say that seven or nine levels are better. It could look like this:

(i) agree (ii) strongly agree (iii) neither agree nor disagree (iv) disagree and (v) strongly disagree.

Our study used a 3-point Likert scale to find out how familiar the respondents were with industrial pollution, and a 5-point Likert scale to find out what the respondents think about how environmental protection and the community's problems from industrial pollution work together.

The ambient air quality monitoring network measures a number of air pollutants at different places in the country that are important. There are a lot of things that need to be done to set up a monitoring network. These include choosing pollutants, where to sample, how often, how long, and how to do it. In West Bengal, the regular monitoring of the air quality under the NAMP program started in Kolkata. The monitoring of pollutants in these stations was done for 24 hours, with four-hourly sampling for gaseous pollutants and eight-hourly sampling for particulate matter. This meant that there would be 104 observations in a year. The sampling for 24 hours for a day had been done in three shifts, and from there the average was calculated to get a good idea of how the whole day went. When there were power outages and other problems, the goal of sampling for 24 hours in a day could not be met at all locations. The values that have been recorded for 16 hours or more are considered to be representative of the air quality for that day. Some places didn't meet the goal of monitoring twice a week, 104 days a year. In these cases, 40 or more days of monitoring in a year was enough for data analysis.

Air Quality Assessment

West Bengal Pollution Control Board, the Central Pollution Control Board, and the Centre for Science and Environment have given us the data we need to figure out how clean the air in Kolkata is outside (CSE). An assessment of the average concentration of ambient air pollution in Kolkata has been done by looking at the data from all 17 monitoring stations for each month and comparing the average value to the NAAQS that was set for that month. This is how it works: The Exceedence Factor (EF) method, which was developed by the CPCB, has been used to figure out how bad the air pollution is. This means that the ratio of the annual mean concentration of a pollutant to that of a standard is used to figure out how bad the air is. The EF equation has been used to classify the air quality into four broad categories: low, moderate, high, and critical. This is how the trend analysis of air quality has been done: It has been done by comparing the recorded data from WBPCB with the NAAQS, and then drawing line graphs to show the data

Data Analysis

Using SPSS software, the data from the questionnaire survey was entered. The simple percentage, tabulation, cross-tabulation, and average mean were used to figure out how many people answered each question correctly. MS Excel was used to make bar graphs and pie charts that show both primary and secondary data in a way that was easy to understand.

Result and Discussion

The monthly average concentration of pollutants shows how much pollution the city might have over the whole year. It shows how much pollution the city might have in the air for different months of the year. The amount of pollution that is shown by the monitoring stations. The study found that the monthly average concentrations of pollutants in terms of NO2 and RPM were higher in November and December than they were in October and September. In the case of RPM concentration, the value in January was the highest and was found to be more than twice as high as the national average. Because of the way the seasons work, there may be a lot more pollution in these months than in other times. The winter season lasts from November to February in the northern part of the country. Vertical movement of wind stops in winter when pressure changes (most likely due to high pressure on the ground). This means that pollutants stay concentrated at ground level for a longer time, which leads to the high concentration. During August and September in 2010, the lowest NO2 and RPM levels were recorded at 38.3 g/m3 and 37.1 g/m3 for NO2. For RPM, the lowest levels were recorded in July and August at 28 g/m3 for NO2. Monsoons may be to blame for the lowest values in these months (the months comprising June to September are the monsoon season in Northern India). The SO2 level stayed within the national standards for the whole year that we were monitoring it. Another thing you need to know: In this analysis, the monthly average concentration that was talked about here was not used for either identifying dispensaries or determining which months to do a health survey. Air quality for the city is shown in general terms, with different pollutant concentrations fluctuating each month over time.

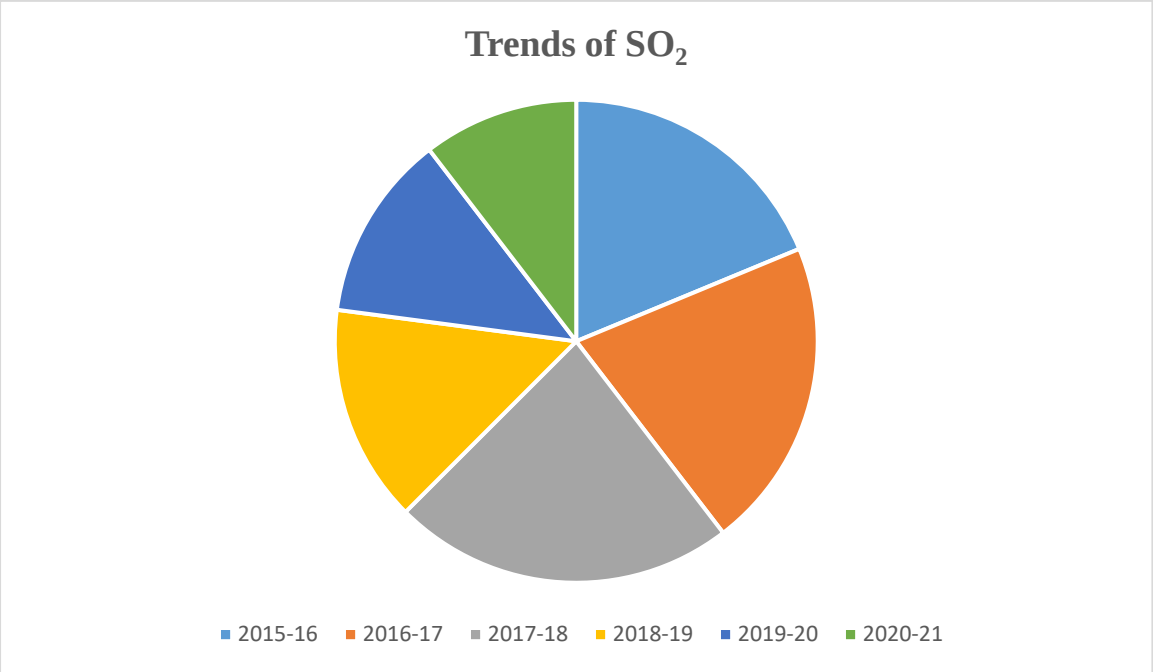
Table 1: Monthly average concentrations of ambient air quality in Kolkata

Sl. No.	Months	Monthly Average Concentration ($\mu g/m^3$)			
		SO_2	NO_2	RPM	SPM
1	10 April	7.6	50.2	45	117
2	10 May	5.4	42.3	35	96
3	10 June	5.0	43.8	34	90
4	10 July	4.4	39	28	77
5	10 August	4.2	38.3	28	75
6	10 September	4.4	37.1	34	88
7	10 October	6.1	49.3	63	155
8	10 November	7.9	65.8	127	265
9	10 December	9.9	78.9	179	342
10	11 January	9.2	94	211	-
11	11 February	8.2	79.7	172	-
12	11 March	5.5	59.7	96	-

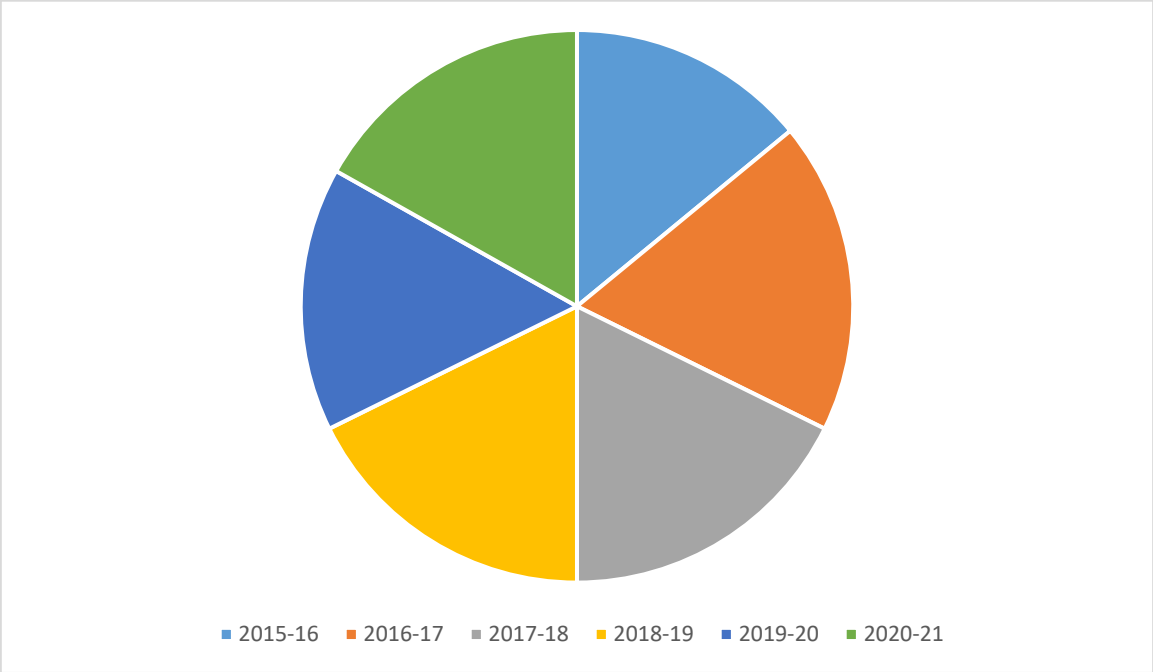
Note: (NAAQS: SO_2–80 $\mu g/m^3$; NO_2–80 $\mu g/m^3$; RPM–100 $\mu g/m^3$; SPM–No Standard). Source: WBPCB

The Exceedence Factor (EF) equation was used to look at the criteria pollutants. It found that out of 17 monitoring stations, SO2 was found to be low in all of them. Some 12 places were in the "high" category, and the other five places had a "critical" level of pollution when it came to NO2. For RPM (PM10), 10 places were in the "high" category, and the other seven places were in the "critical" category. RPM and NO2 levels, as measured in this study, are found to be limited at the 17 monitoring stations. This could also mean that Kolkata's air pollution is at a dangerous level that should not be considered safe for healthy city living. The identification of different sources that make the air in the city unhealthy to breathe is very important.

To figure out how much pollution is in the air and how it changes over time, a trend analysis has been done with the pollutants that are important, like SO2, NO2, RPM, and SPM, in Kolkata. During all of the monitoring years, the trends in the annual average concentration of SO2 have been lower than the NAAQS. This meant that the concentration of SO2 in the air around Kolkata was going down. Each monitoring year, the average amount of NO2 in the air has been found to be higher than the National Ambient Air Quality Standard (NAAQS).



Trend of NO_2



Diseases Analysis

More than 90% of the people who went to Behala and Tangra Dispensaries had respiratory diseases, while Ultadanga Dispensary had 71.4 percent of people who had respiratory diseases there. In Ultadanga Dispensary, 21.4 percent of patients have ARI, 10.7 percent have COPD, 35.7 percent have influenza, and 3.6 percent have UTRI, among other things. People with ARI make up 72.4 percent of people who go to Behala Dispensary. People with COPD make up 10.3 percent, and people with acid fast bacillus (AFB) make up 10.3 percent. patients with pulmonary TB or other mycobacterial lung infections, like chronic cough, are

called AFB patients. In Tangra Dispensary, 86.1 percent of respiratory patients have ARI, which is more common than any other type of infection (90.9 percent). People can make the assumption that the disease categories covered in this study are more or less the same across the dispensaries that were looked at. It doesn't seem like there is a clear pattern that shows that a lot of pollution leads to more illnesses of the respiratory system. The pollution level could be very hard to connect with one type of disease. It could be because you've been exposed to air pollution for a long time. People with respiratory illnesses could be more common because of air pollution in this study. This could be a bad thing to say, though. For these kinds of conclusions to be made, an exposure assessment must be done by taking into account the work habits of the people being studied. However, the paper doesn't cover that kind of thought. These respiratory diseases may be a concern for future studies that use a specific method to look for a link between exposure to pollutants and diseases that people get.

Table 2. Disease pattern at dispensaries

Name of the Dispensary	% Respiratory Diseases					Total	% Waterborne Diseases		Total
	ARI [1]	COPD [2]	Influenza	UTRI [3]	AFB [4]		Diarrhoea	Ringworm	
Ultadanga Dispensary	21.4	10.7	35.7	3.6	-	71.4	25.0	3.6	28.6
Behala Dispensary	72.4	10.3	-	-	10.3	93.1	6.9	-	6.9
Tangra Dispensary	86.1	2.3	2.3	-	-	90.9	9.3	-	9.1
Average	60.0	7.8	12.7	1.2	3.4	85.1	13.7	1.2	14.9
Total			85.1		100			14.9	

Note: [1] Acute respiratory infection; [2] Chronic obstructive pulmonary diseases; [3] Upper tract respiratory infection; [4] Acid fast bacilli.

Conclusion

The concentration of RPM and NO2 in the air around us has been found to have broken the national standards and exceeded the NAAQS, which are set by the government. As you look at the pollution concentration, most of the monitoring stations fall into the critical and high-pollution groups. People have used the pollution categories that were found to choose the places where the health survey will be done. People who live in slums are found to make up a large percentage of the people who took part in the survey. People who have respiratory illnesses make up the majority of the people who took part. Slum dwellers may not be getting as much pollution as people who live in other parts of the city, which is why they get more respiratory illnesses. If they are more likely to get the kinds of diseases the study is looking at, more research might be needed to find out what else might be going on with their health. Poor living conditions, a lack of knowledge about pollution, indoor cooking, and a lack of resistance to air pollution could all make slum-dwellers more likely to get pollution-related diseases. People living in the slums of Kolkata are most likely to cook in their living rooms, as this study shows.

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