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PRASANTA CHANDRA MAHALANOBIS MAHAVIDYALAYA
111/3 B.T. Road, Kolkata - 700 108

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IMPACT OF THE LOCKDOWN PERIOD ON THE AIR QUALITY IN KOLKATA METROPOLIS DURING COVID-19

Dr. Alpana Ray

Assistant Professor, Department of Geography

Prasanta Chandra Mahalanobis Mahavidyalaya, Bonhooghly, Kolkata

Abstract

On March 24, 2020, Kolkata, a megacity located in the eastern part of India announced lockdown due to COVID- 19 crisis and it results in lowering of ambient air quality in the air. This research highlights an analysis for multiple pollutants with special focus on $PM_{2.5}$, PM_{10}, NO_2 based on data from different monitoring stations located across Kolkata city under West Bengal Pollution Control Board, for the period of 1st March-November, 2020. A comparison was done with the pre-lockdown period of February–March 2020 with Post Lockdown Period October-November 2020 in different monitoring stations showing Air Quality Index in different stations across the city. Most significantreduction was observed in the concentration of nitrogen dioxide (NO_2), PM_{10} (- 64.6%) and $PM_{2.5}$ (- 65.9%). A lower percentage reduction was found for CO, sulphur dioxide (SO_2). The Air Quality Index (AQI) in Kolkata which was poor or very poor in the past even during lockdown period it failed to attain the 'good' standard. This needs special attention in human health impact assessment and public health management in the Lockdown period. The Research Paper highlights some major policy implications of the observed trends to combat city air pollution.

1. INTRODUCTION:

Air pollution has been a serious environmental concern, that has increased significantly over the last decade across many parts of India with severe consequences on human health and well-being (AQMC, 2019). Air pollution is one of the major environmental problems that affect everyone. It occurs when the environment is contaminated by any chemical, physical or biological agents that change the natural characteristics of the atmosphere. Stoves at home, motor vehicles, industrial activities and forest fires are the common sources of air pollution. Pollutants of major public health concern include particulate matter, carbon monoxide, ozone, nitrogen dioxide and sulphur dioxide. Both ambient (outdoor) and household (indoor) air pollution cause respiratory and other diseases, which can be fatal (Dasgupta, 2005).

In December 2019, a disease named COVID-19 was spread among nearly hundred countries of the world with devastating consequences. The disease was first identified in Wuhan of China and by March 11, 2020 a new Corona virus SARS- COV-2 was spread among all the nations and it was declared as Pandemic (WHO, 2020). To control the infection, countries have restricted the movement of people, transports, large scale gathering and enforcing quarantine and social distancing. In India Corona virus spread in an alarming rate among all the states of the country and the government declared a nationwide Lockdown to restrict the disease since 24th march, 2020. Nationwide Lockdown restricted not only the movement of people, transports but also played a significant role in improving the air quality by restricting the emissions of pollutants in the environment. Due to the restricted movement of personal vehicles and other transports on road and low Industrial activities in this period have resulted very low emission of different pollutants like PM_{10}, $PM_{2.5}$, Nitrous Oxide and Carbon monoxide in the air.

18 April 2021, there have been over 140 million confirmed cases of COVID-19, and In India, from 3 January 2020 18 April 2021, there have been 1,47,88,109 confirmed cases of COVID-19 with 1,77,150 deaths, reported to WHO. The death toll is reached to 30 lakh as on 18.04.2021 over the world (WHO 2021). Due to the contagion of COVID-19, a nationwide lockdown is imposed in India from March 24th for three weeks up to 14th of April and later extended up to 3rd May. By this nationwide lockdown almost all industrial activities and mass transportation have been prohibited. The Indian government, as in many other countries, responded to the COVID-19 pandemic b enforcing a variety of restrictions on normal activity, including complete lockdowns that led t severe disruptions in economic activities. As a result, the pollution level in cities in India across th country drastically lower down only after four days of commencing lockdown event according the official data from the CPCB (CPCB 2020).

During Pre-COVID-19 period, Kolkata city's ambient air quality and related disease burden ha been in discussion not only in mass media but also in journals and among policymakers a citizens. National Green Tribunal (NGT) imposed a penalty of INR 100 million on the St Government of West Bengal because it failed to check air pollution in Kolkata and other parts West Bengal (NGT 2019). Air pollution reduction in cities is getting importance not only for hum health reason but also for its close link to climate co-benefits (Bera, 2020). IPCC report has no that air pollution reduction and climate mitigation actions are synergistic and are also positiv linked to multiple SDGs (sustainable development goals). Like many other countries, India also national standards for local air pollutants (Table 1). Therefore, lockdown is a very effect alternative measure to be implemented for controlling air pollution and the present research w

aims to find out the air quality change during lockdown at spatial scale in the different parts of the Kolkata Metropolis and will suggest possible remedial solutions.

Table:1 Revised National Ambient Air Quality Standards (NAAQS) vis-a-vis WHO Standards

Sl. No.	Pollutants	Time Weighted Average	NAAQS- India (Industrial, Residential, Rural and other Areas	WHO Standards
1.	Sulphur Dioxide (SO_2), µg/m3	Annual	50	
		24 hours	80	20
2.	Nitrogen Dioxide (NO_2), µg/m3	Annual	40	40
		24 Hours2	80	
3.	Particulate Matter (Size < 10µm) or PM_{10} µg/m3	Annual	60	20
		24 Hours	100	50
4.	Particulate Matter (Size < 2.5µm) or PM2.5 µg/m3	Annual	40	10
		24 Hours	60	25

Source: (Central Pollution Control Board, MoEFCC, 2014; World Health Organization, 2006)

2. STUDY AREA:

Kolkata Municipal Corporation area is bounded by river Hugli in the Northwest, South 24 Parganas district in the south and southwest, Salt Lake City in the east and North 24 Parganas district in the north. The area falls between north latitudes of 22°28′ 00″and 22° 37′30″ and east longitudes 88°17′30″ and 88°25′00″. KMC covers an area of 187.33 sq.km. and is divided into141 wards (Figure:1) and 15 number of boroughs.

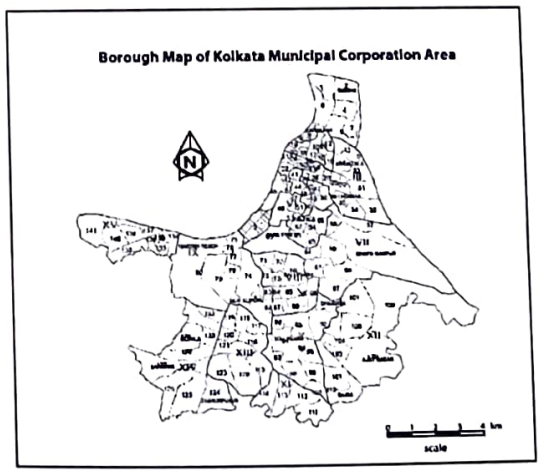


Figure: 1

3. RESEARCH PROBLEM AND RESEARCH METHODOLOGY:

The major sectors contributing to air pollution are transport, industries, power plants, construction activities, biomass & refuse burning, road dust resuspension and residential activities. In addition, certain activities such as operation of DG sets, restaurant, landfill fires, etc. also contribute to air pollution (Ghosh & Somanathan 2013). Under the nationwide lockdown, all transport services road, air and rail were suspended with exceptions for essential services. Sectors like industrial establishments, construction activities, commercial and hospitality services, etc. were also suspended. As a result of the reduction of emissions from various sources, air quality improvement has been noted in many towns and cities across substantial reduction in pollutant concentrations during lockdown. The concentration of NO_2, $PM_{2.5}$ and PM_{10} levels show reduction in pre-lockdown, lockdown phase-I and lockdown phase-II, against the levels observed in March 2020 with the quantum of reduction improving in each stage for most of the pollutants (Bera et al. 2020). The West Bengal State Pollution Control Board (WBPCB) has set up air-quality monitoring network across West Bengal to report hourly air quality on daily basis, in conformity with the revised National Ambient Air Quality Standards (NAAQS), noticed on 18November 2009. Our study covered data from six stations located in central zones within a radius of 6.6 km i.e. Ballygunge, Bidhannagar, Esplanade area - Fort William, B.T. road area - Rabindra Bharati University, Rabindra Sarovar and Park Street -Victoria of Kolkata (Fig. 1).

To study the effect of Lockdown in diurnal variation of pollutant concentration for all the previously mentioned six stations, the station-specific air portal (WBPCB, 2020) quality data were obtained from the Central Pollution Control Board (CPCB) online for a duration 1st to 15th of the February 2020 to 17th May 2020, where air quality data from February 2020 to March 2020 has been considered as the pre-lockdown phase. The pollutants concentration data during different lockdown phase has been compared with the pre-lockdown phase.

4. DATAANALYSIS:

Kolkata, the seventh most populous city in India as well as a major commercial and financial hub of eastern India (TEERI 2020). The nationwide Lockdown, imposed from the midnight of 24th March 2020, in view of COVID-19 pandemic, has resulted in significant improvement in air quality in the country, as revealed by data analysis and comparison of data for time before enforcement of restrictions, and the corresponding time periods in the previous year. The Lockdown was announced after a 14-hour voluntary curfew called "Janata curfew" which was observed on 22nd March 2020. On 14th April 2020, the nationwide lockdown was extended until 03rd May 2020 with conditional relaxation, such as opening up of government offices, operation of industrial estates and Special Economic Zones (SEZs), construction works and brick kilns in rural areas, etc. in the regions where the pandemic spread had been contained.

In South Kolkata, Ballygunj area the AQI was quite high before Lockdown i.e. March, 2020 (234) and after that on 1st April, 2020 it dropped to 132 and it became the two digit figure i.e. 16 as on 1st July, 2020. But during unlock period the value again increased and by December 2020 it reached to 245 (Figure: 2) and the regression line also falls very sharply as seen in the graph. In Budhannagar station the Air Quality Index was very high i.e. 234 before lockdown period. After March, 2020 it dropped to just 67 in April, 28 in May and 24 in June. After September, 2020 it was increased and reached 253 by December, 2020. In the core of Kolkata City also similar type of characters were identified, Fort William area which is CBD part of the city also had very high AQI before Lockdown period but after Lockdown the AQI also dropped to 38 in June, 2020 and post lockdown period it again increased to 253 by December, 2020. Victoria which is located in very congested part of the city also had high AQI before Lockdown period and also the AQI dropped to 31 as on 1st of May, 2020 from 285 (1st January, 2020) due to the restriction of public and public vehicles in this area of the city and the regression line sharply falls during this Lockdown phases. In Rabindra Bharati area of northern part of the city and in Jadavpur area in the southern part also exhibit similar kind of picture (Figure:2).

Kolkata is situated quite close to the Bay of Bengal, and subsequently is prone to influences of phenomena like sea breeze, etc. During the second phase of lockdown, overall 55%- reduction in PM2.5 and 65% in PM10 levels were observed, compared to March 2020 levels, much increased than the 31% and 36% reduction for the same pollutants seen in the first phase of lockdown (WBPCB, 2020). This may be attributed to restrictions on industrial operations and construction activities along with reduced dust resuspension. Further, 63% reduction in NO_2 levels was observed during phase- II of lockdown, indicating the reduction in number of on-road vehicles. Since the pandemic situation was reported as very serious in Kolkata even after 20th April 2020, it is likely that not much relaxations were provided and the administration strictly enforced the lockdown, which is why the air quality improved even in the second phase of lockdown. However, SO_2 levels increased by 24% and 37% in the first and second phase of lockdown as compared to March 2020 levels respectively (CPCB Report, 2020). This may be due to the presence of power plants and their operational variations in the surrounding areas. Despite the increase in SO_2 levels as compared to last year, 24-hourly average $PM_{2.5}$, PM_{10}, CO and NO_2 levels were within National Ambient Air Quality Standards for all days in the lockdown period.

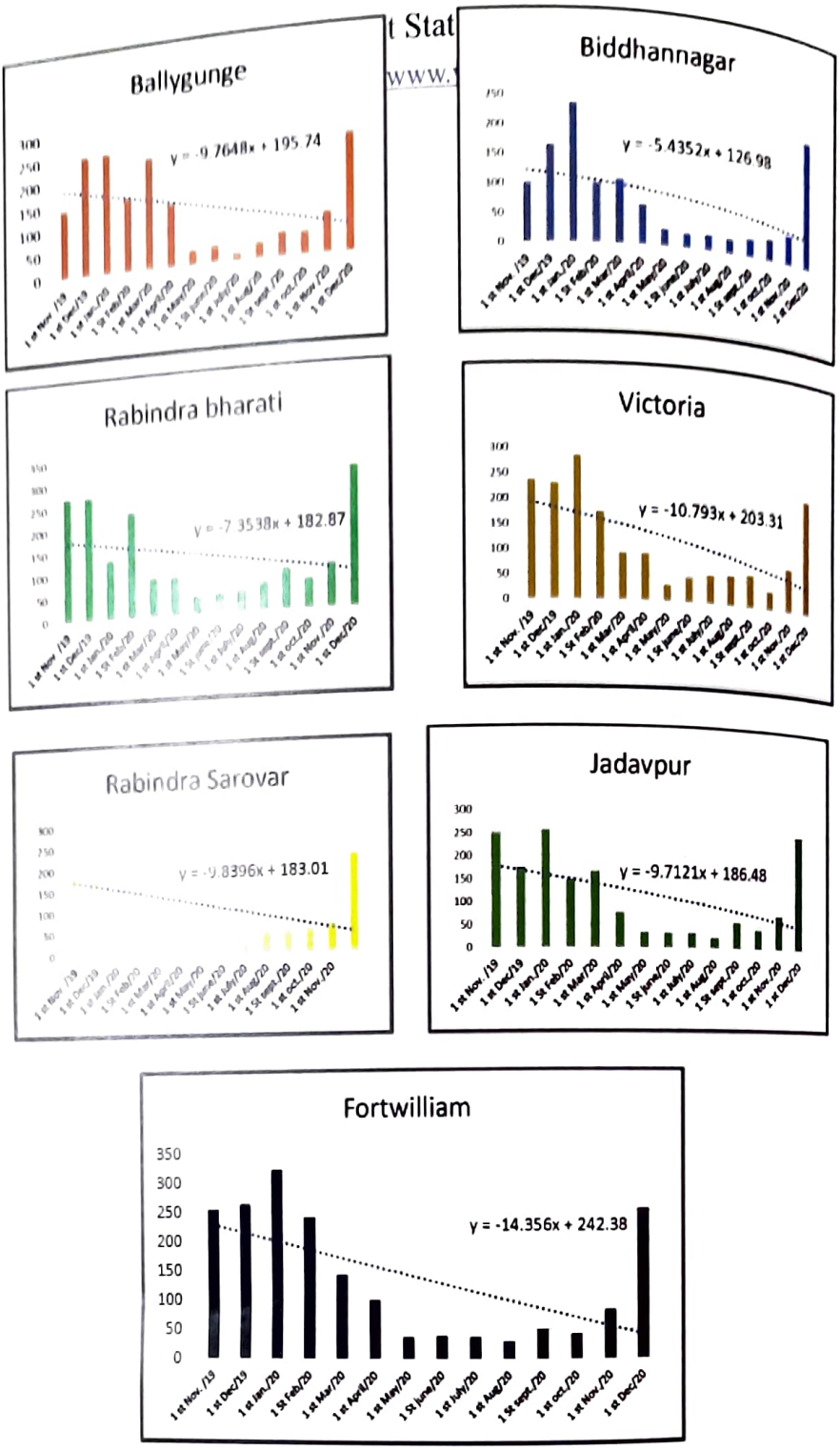
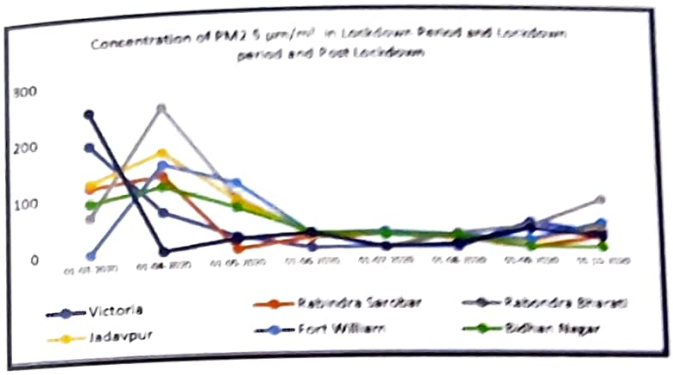
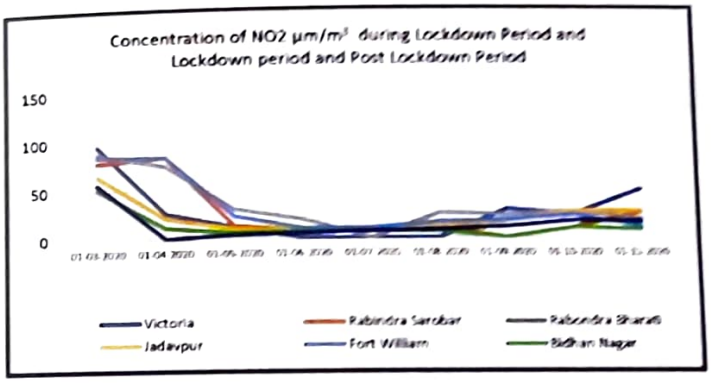


Figure :2 (AQI in Different Stations in Kolkata Metropolis)

Source: www.wbpcb.in

Pm_{10} was very much reduced in all stations in Kolkata during Lockdown period. In Ballygunj area it was reduced from 163 to 35 during Lock down period. Mostly all the stations like Bidhannagar, Jadavpur area, Victoria, Fortwilliam, Rabindra Sarobar and Rabindra Bharati area the $PM_{2.5}$ graph was decreasing at a faster rate during Lockdown period and it proved that due restriction in the movement in transports and industrial activities in the city the air quality has improved a lot. $PM_{2.5}$ and NO_2 graph for the above stations are also decreasing in the aboveperiod in the different stations of the metropolis (Figure:3)





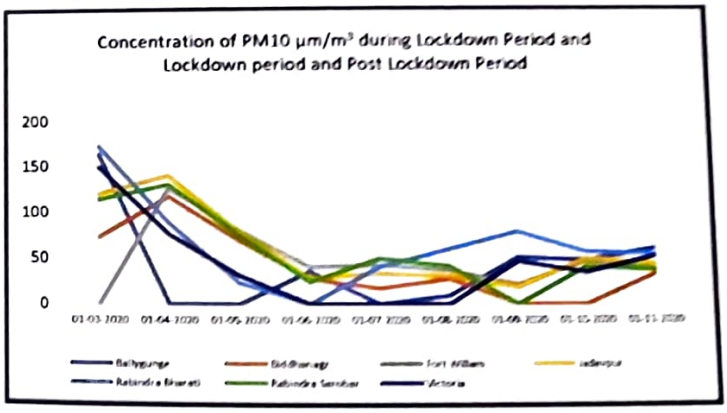


Figure: 3 : Concentration of PM_{10}, NO_2 and $PM_{2.5}$ µm/m3 during Lockdown Period and Lockdown period and Post Lockdown Period in Kolkata City

5. CONCLUSION

The lockdown imposed during COVID-19 pandemic led to a positive effect on air quality in cities across India. In Kolkata Metropolis Air Quality Index (AQI) was improved during the lockdown period. The Lockdown period appears to show drastic changes in improving air quality over these densely populated areas. Although significant improvement in air quality was observed during lockdown due to restricted anthropogenic activities, but the lives of hundreds of millions were disrupted due to the lockdown in response to the COVID-19 pandemic. Irreversible emission reductions through sustainable process changes and long-termobjectives are crucial for achieving good air quality levels. However, as impact of various anthropogenic activities is now being quantified, actions that can be integrated in business-as- usual scenarios needs to be identified, with emphasis on reduction of emissions at source including dust control, vehicular emissions, industrial operations, etc. Lessons learnt from the COVID-19 pandemic can be utilized to target source specific actions leading to maximum improvement in ambient air quality. The results will attract the Government to ponder on how to strictly minimize vehicular and industrial pollution to improve the air quality which will help to sustain better public health in India.

REFERENCES

1. AQMC (2019). Comprehensive Air Quality Action Plan for Kolkata by Air Quality Monitoring Committee (AQMC), Government of West Bengal. CPCB. 2014. 6-10.
2. Bera, B., Bhattacharya, S. & Sil, P. (2020) Significant impacts of COVID-19 lockdown on urban air pollution in Kolkata (India) and amelioration of environmental health. Environment, Development and Sustainability.
3. Dasgupta, M. (2005). Economic Analysis of Health Benefits from Air Pollution Reduction: Comparative Case Study of Delhi and Kolkata.
4. Ghosh, P., and R. Somanathan. (2013). Improving Urban Air Quality in India Lessons fr the Kolkata Clean Air Regulations of 2009. 13-19.
5. Gupta, U. (2008). Valuation of Urban Air Pollution: A Case Study of Kanpur City in In Environmental Resource Economics, 41, 315-326.
6. KMC. (2018). Kolkata Municipal Coporation, Basic Statistics. Retrieved June 8, 2020, https://www.kmcgov.in/KMCPortal/jsp/BasicStatics.jsp
7. Majumdar, C. (2010). The Health Cost of Air Pollution in Kolkata. The Indian Eco Journal, 58(1), 95-109.
8. National Air Quality Index. India: Central Pollution Control Board (CPCB).
9. NGT, 2019: National Green Tribunal (NGT). 1–11.
10. TERI. (2020). Successful Operation of Electric Bus Fleet – "A Case Study of Kolkat Delhi.

WBPCB, 2019. West Bengal Pollution Control Board (WBPCB) Report: Clean Air is Our Birth Right, Fight for Right. 35-46.

World Health Organisation. (2016). Ambient air pollution: A global assessment of exposure and burden disease. Geneva.

World Health Organization. (2006). WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide; Global update 2005.

WHO (2020). Coronavirus disease (COVID-19) pandemic. https ://www.who.int/emergencies/diseases/novel-coronaviru s-2019.

WHO (2020).Coronavirus Disease 2019 (COVID-19) Situation Report-36.https ://www.who.int/docs/ default-source/coronavirus/situation-reports.