



## India's Caronavirus Lockdown Effects On Pollution: A Study

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**Abstract** The lockdown measures imposed by the Government of India to control the spread of novel coronavirus have led to a dramatic improvement in the air quality across the country. The new satellite map of India shows that the pollution levels have significantly reduced in major cities across the country particularly the worst affected Delhi. It is always perceived that the worst must be considered for the study and so one air quality monitoring net work station R K Puram, Delhi is chosen for study. The main aim of the study is to the impact of repeatedly extended lockdowns on pollution particularly the worst pollution affected Delhi. This micro study utilizes a qualitative approach to analyze the impact of lockdown on air pollution and outcome of it may be applicable to macro level.

**Keywords:** Lockdown, Novel Coronavirus, Pollution, Satellite Map.

### 1. Introduction

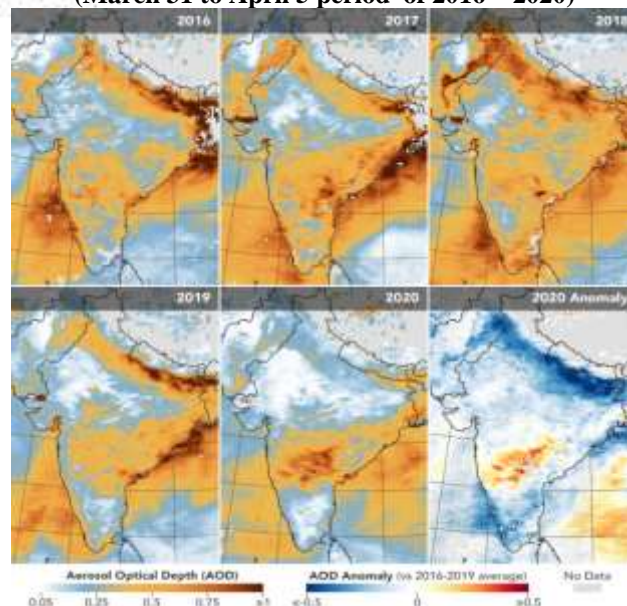
India, caught up in dealing with Caronavirus pandemic, was forced to announce nationwide lockdown on 24 March for 21 days starting from 25 March to 14 April, extended the second lockdown from 15 April to 2 May and additional extension of lockdown clamped up to 17 May, 2020 as precautionary and containment measures. The Indian Government placed its 1.3 billion citizens under a strict lockdown and virtually shutting down the country to reduce the spread of the Covid-19, Coronavirus. Social curfew was clamped, people are confined to their homes staying indoors, factories have shut and for the first time in history, the Indian railways stopped operations across the country. The country-wide directive decreased activity at farms and severely reduced car, bus, truck and airplane traffic and it became almost standstill. Marriages, celebrations, fairs, festivals and pilgrimages are ceased. The sudden and dramatic change like lack of vehicles on the roads, shuttered industries and the halting of construction has brought about modifying or declining aerosol levels in the country.

#### 1.1 Aerosols

Aerosols from anthropogenic or human-made sources contribute to unhealthy levels of air pollution in many Indian cities. Aerosols are tiny solid and liquid particles suspended in the air that reduce visibility and can damage the human lungs and heart. Some aerosols have natural sources, such as dust storms, volcanic eruptions, and forest fires. Others come from human activities, such as the burning of fossil fuels and croplands. Human-made aerosols tend to contribute most of the smaller particles that have greater potential for damaging human health. The unprecedented

lockdown locked up and contained further escalation of air pollution. It is an opportunity for the scholars to take a closer look at how air pollution levels have declined to this situation and what we can learn from the repercussions. After just weeks of reduced human activities, NASA satellite sensors observed the aerosol levels at a 20-year low for this time of year in northern India. The following 6 maps show aerosol optical depth (AOD) measurements over India during the same March 31 to April 5 periods of 5 years from 2016 to 2020.

**MAPS- AEROSOL OPTICAL DEPTH (AOD)  
MEASUREMENTS OVER INDIA  
(March 31 to April 5 period of 2016 – 2020)**



**Source:** The data were retrieved by the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Terra satellite. Image via NASA Earth Observatory.

The first 5 above maps show Aerosol Optical Depth (AOD) measurements over India during the same March 31 to April 5 period of 2016, 2017, 2018, 2019 and 2020. The 6th map (anomaly) shows how AOD in 2020 compared to the average for 2016-2019. Aerosol optical depth is a measure of how light is absorbed or reflected by airborne particles as it travels through the atmosphere. If aerosols are concentrated near the surface, an optical depth of 1 or above indicates very hazy conditions. An optical depth, or thickness, of less than 0.1 over the entire atmospheric vertical column is considered as clean.

## 2. Deliberations

The environmental changes are asserted by Dr. Pawan Gupta, a Universities Space Research Association (USRA) scientist at NASA's Marshall Space Flight Centre. He says that the changes would be seen in atmospheric composition in many places during the lockdown. He also says he has never seen aerosol values so low in the Indo-Gangetic Plain at this time. It is because of the lockdown that has reduced the man made emission. Mr. Anumita Roy Chowdhury of the Delhi-based Centre for Science and Environment said he had never really experienced clean air like that and it was an amazing experience. He emphasised to capitalise and learn from the situation. India's Central Pollution Control Board and other monitoring centres have all reported a major fall in pollution levels in the Indian capital as well as other major cities. New Delhi, one of the world's most populated capitals and regularly listed as one of the world's most polluted cities, is now experiencing azure skies and clean air as a result of the covid lockdown. People of North India are thrilling to spectacle the Himalayas from their places for the first time in decades. All these expressions support the statement that the satellite images over northern India show strikingly how aerosol levels which have dropped since the lockdown began. In this perspective there is a need to study further the impact of lockdown on pollution in India.

## 3. Pollution

Pollution is the introduction of harmful material contaminants into the natural environment. They cause air pollution, light pollution, noise pollution, soil contamination, radioactive contamination, thermal pollution, visual pollution, water pollution and ultimately the air quality worsens. For instance, according to a recent survey of the WHO, the air quality of Delhi, the capital territory of India, is considered to be one of the worst air quality major cities in the world. The situation so bad that on 25 November 2019, the Supreme Court of India having observed and made comments on the pollution in Delhi saying "Delhi has become worse than narak (hell)". Justice Arun Mishra of the Supreme Court had a pungent experience to say it is better to get explosives and kill everyone. Hence, Delhi has been constantly in the news for the very concerning reason of dangerously poor Air Quality Index scale. The causes are multifarious.

### 3.1. Causes

Burning of crops by farmers in neighbouring states, vehicular smoke and other gaseous emissions, onset of winter resulting in air molecules become heavy and dense, and lack of strong winds causing notorious smog cover, fine dust from construction

activities contributing to the toxic mix of smog, cement factories and coal fired brick kilns in the neighbouring states, residual smoke from firecrackers increasing the number of toxic metals in the air, etc., are some of the primary causes of air pollution in Delhi. There are many air quality monitoring stations to measure in real time particulate materials and other pollutants. There are ambient air quality monitoring network of 38 stations in Delhi. In Delhi, Anand Vihar, R K Puram and Punjabi Bagh are declared to be perennially polluted areas in terms of air quality. Hence, one among the three notorious stations, R K Puram, Delhi, is selected to collect the required ambient air quality data for discussion and analysis.

## 4. Methodology

India has been experiencing the pandemic since the first case of the COVID-19 reported on 30 January 2020 and to prevent and contain the acceleration of caronavirus, lockdown had been announced and then it was extended and also further extended, the result of which virtually shutting down the movements and production activities in the country. The environment has improved dramatically and unexpectedly. The main aim of the paper is to study the impact of repeatedly extended lockdowns on pollution particularly the worst affected Delhi. This study utilizes a qualitative approach to analyze the impact of lockdown on the air pollutants such as PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>2</sub>, SO<sub>2</sub>, CO, etc., and their measurement of ambient concentrations in selected study area. The selected study area is R K Puram, Delhi, one among 38 stations, which is deemed to be sample represent the whole of Delhi city. The very limitation is the observations of a small area may not reflect the true picture of the air quality of the broad area of Delhi.

## 5. Analysis of Ambient Air Quality Data

The ambient of outdoor air quality and pollutant data is analysed in the following paragraphs. Particulate Matter (PM) is a common proxy indicator for air pollution. The major components of PM are sulfate, nitrates, ammonia, sodium chloride, black carbon, mineral dust and water. It consists of a complex mixture of solid and liquid particles of organic and inorganic substances suspended in the air. The PM affects more people than any other pollutant. The particles with a diameter of 10 microns or less, ( $\leq$  PM<sub>10</sub>) can penetrate and lodge deep inside the lungs, the even more health-damaging particles are those with a diameter of 2.5 microns or less, ( $\leq$  PM<sub>2.5</sub>). The PM<sub>2.5</sub> can penetrate the lung barrier and enter the blood system. Chronic exposure to particles contributes to the risk of developing cardiovascular and respiratory diseases, as well as of lung cancer.

### 5.1. PM<sub>10</sub>

The ambient air quality with reference particulate material - PM<sub>10</sub> ( $\mu\text{g}/\text{m}^3$ ) recorded at R.K. Puram in Delhi is shown in the following table – 1, table – 1 (a) and table – 1(b)

TABLE - 1: MONTH AND DATE WISE AMBIENT AIR QUALITY- PM<sub>10</sub> ( $\mu\text{g}/\text{m}^3$ ) (1 January TO 13 MAY, 2020)

It can be observed from the table-1 that the particulate material PM<sub>10</sub> was recorded as high as 675 and 422 on 1<sup>st</sup> and 2<sup>nd</sup> January, 2020 which is more hazardous and indicates people should avoid all out door exertion. The numbers have come



down significantly to 28 on 28<sup>th</sup> March, 34 on 27<sup>th</sup> April and it is good to moderate in both the months of April and May (1<sup>st</sup> to 13) after the announcement of lockdown.

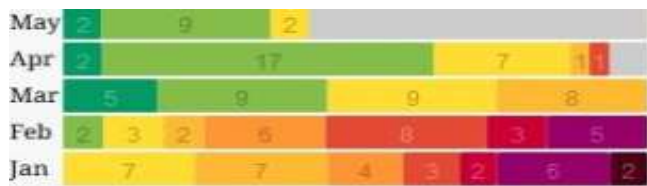


TABLE - 1(a): MONTH WISE SCALE OF AMBIENT AIR QUALITY- PM<sub>10</sub> (µg/m<sup>3</sup>) (1 January TO 13 MAY, 2020)

Month	No. of Days									
	25-50	50-75	75-100	100-125	125-150	150-175	175-200	200-300	300-400	>400
May-13	2	9	2							
April-30	2	17	7	1		1				
March-31	5	9	9	8						
Feb-29		2	3	2	6	8	3	5		
January-31			7	7	4	3	2	6		2

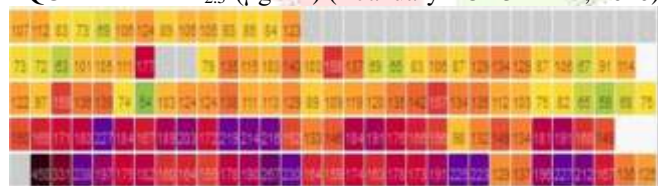
Source: World Air Quality Index project and Delhi Pollution Control Committee (Government of NCT of Delhi), <https://aqicn.org/city/delhi/r.k.-puram/m/>

As table-1(a) and table-1(b) show, the similar scenario can be seen on the post announcement of lockdown, April and only one day falls in the interval of 150-175 indicating good and moderate levels compared to previous month.

### 5.2. PM<sub>2.5</sub>

Since the lockdown, Delhi's particulate matter pollution PM<sub>2.5</sub> has dropped to the maximum level that hasn't been seen in the past many years. The tables – 2, 2(a) and 2(b) show the levels of air quality with reference to particulate matter 2.5 at the monitoring station R K Puram, in Delhi from January to May 13.

TABLE - 2: MONTH AND DAY WISE AMBIENT AIR QUALITY- PM<sub>2.5</sub> (µg/m<sup>3</sup>) (1 January TO 13 MAY, 2020)



As is seen in table-2, PM<sub>2.5</sub>, the most dangerous pollutant, measured at the pollution monitoring station in R K Puram, New Delhi, oscillated between 54 and 450 levels from May 13 to January 1. It was hazardous zone in the month of January.

TABLE - 2(a): MONTH WISE SCALE OF AMBIENT AIR QUALITY- PM<sub>2.5</sub> (µg/m<sup>3</sup>) (1 January TO 13 MAY, 2020)

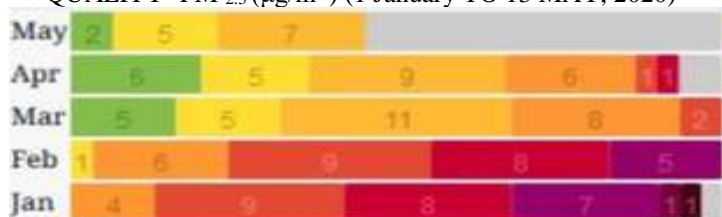


TABLE - 2(b): MONTH WISE SCALE OF AMBIENT AIR QUALITY- PM<sub>2.5</sub> (µg/m<sup>3</sup>) (1 January TO 13 MAY, 2020)

Month	No. of Days									
	50-	75-	100-	125-	150-	175-	200-	300-	>400	
May	2	5	7							
Apr	6	5	9	6		1				
Mar	5	5	11	8						
Feb	1	6	9	6	5					
Jan	4	9	8	7	11					

	75	100	125	150	175	200	300	400
May	2	5	6					
April	6	5	9	6	1	1		
March	5	5	11	8	2			
February	1			6	9	8	5	
January				4	9	8	7	1

Source: World Air Quality Index project and Delhi Pollution Control Committee (Government of NCT of Delhi).

In the months of January and February, before the announcement of lockdown, the pollution levels recorded from unhealthy for sensitive groups, unhealthy, very unhealthy to hazardous. The pollution levels started declining and reached good air quality level during the lockdown period. According to the study, PM<sub>2.5</sub> concentration in RKP, Delhi was the highest at 450 micrograms per cubic metre on the 2<sup>nd</sup> January and the least at 54 level. It can be deduced that very low vehicular traffic, negligible manufacturing and commercial activities due to the coronavirus forced lockdown which is weather favourable for dispersion of pollutants, more than 50 per cent depletion in PM<sub>10</sub> concentrations and 45 per cent reduction in PM<sub>2.5</sub> levels in the study area. Hence, during the lockdown PM<sub>10</sub> and PM<sub>2.5</sub> concentration levels were reduced to good because of the reduction in vehicles plying and dust.

### 5.3. Ozone (O<sub>3</sub>)

TABLE – 3: MONTH WISE AND DAY WISE AMBIENT AIR QUALITY- O<sub>3</sub> (1 January TO 13 MAY, 2020)



TABLE – 3(a): MONTH WISE AMBIENT AIR QUALITY- O<sub>3</sub> (1 January TO 13 MAY, 2020)



TABLE – 3(b): MONTH WISE SCALE OF AMBIENT AIR QUALITY- O<sub>3</sub> (1 January TO 13 MAY, 2020)

Month	No. of Days									
	0-25	25-50	50-75	75-100	100-125	125-150	150-175	175-200	200-300	300-400
May		6	1	1						
Apr	1	19	2	4	2					
Mar	14	14	1	1	1					
Feb	29									
Jan	29	2								

### 5.4. Nitrogen Dioxide (NO<sub>2</sub>)

TABLE – 4: MONTH WISSE AND DAY WISE AMBIENT AIR QUALITY - NO<sub>2</sub> (1 January TO 13 MAY, 2020)

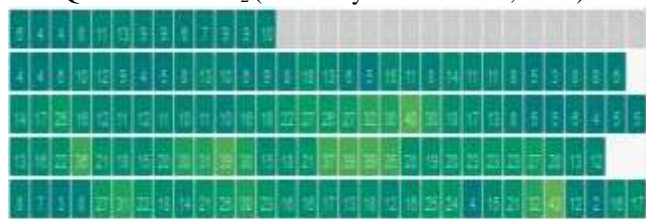


TABLE – 4 (a): MONTH WISSE AMBIENT AIR QUALITY- NO<sub>2</sub> (1 January TO 13 MAY, 2020)

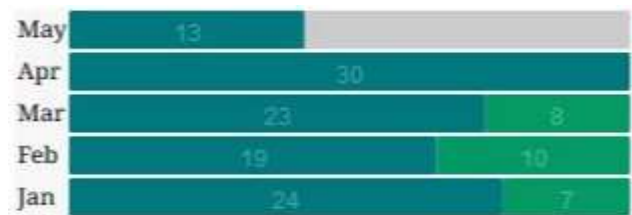


TABLE – 4(b):MONTH WISE SCALE OF AMBIENT AIR QUALITY - NO<sub>2</sub>(1 January TO 13 MAY, 2020)

Month	No. of Days									
	0-25	25-50	50-75	75-100	100-125	125-150	150-175	175-200	200-300	300-400
May	13									
Apr	30									
Mar	23	8								
Feb	19	10								
Jan	24	7								

The table -4 shows that Nitrogen dioxide (NO<sub>2</sub>) in Delhi released by main contributor of transport and power plants records a significant fall from 43 the highest being in January, highest frequency in February with 10 in the class 25-50 and higher in March with 8 in the same class. But soon after the announcement of lockdown the Nitrogen Oxide (NO<sub>2</sub>) levels in the study area fell down rapidly during the lockdown period April and May and the result of which the air in Delhi has improved significantly.

### 5.5. Sulphur Dioxide (SO<sub>2</sub>)

TABLE – 5:MONTH WISSE AND DAY WISE AMBIENT AIR QUALITY - SO<sub>2</sub>(1 January TO 13 MAY, 2020)



TABLE – 5 (a):MONTH WISSE AMBIENT AIR QUALITY- SO<sub>2</sub> (1 January TO 13 MAY, 2020)

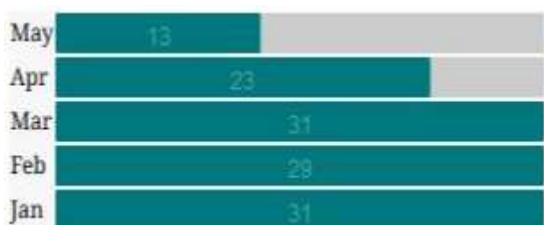


TABLE – 5(b):MONTH WISE SCALE OF AMBIENT AIR QUALITY - SO<sub>2</sub> (1 January TO 13 MAY, 2020).

Month	No. of Days									
	0-25	25-50	50-75	75-100	100-125	125-150	150-175	175-200	200-300	300-400
May	13									
Apr	23									
Mar	31									
Feb	29									
Jan	31									

It can be seen from the table – 5 that there is a slender decrease in sulphur dioxide (SO<sub>2</sub>) concentrations and it was 23 in April, a completter lockdown time when it is compared to the previous months March, February and January, 2020. It could be perceived that it could be due to no restrictions on power plants in northern India, and the usage of coal powered energy as an essential commodity during the lockdown period.

### 5.6. Carbon Monoxide (CO)

TABLE – 6:MONTH WISSE AND DAY WISE AMBIENT AIR QUALITY – CO (1 January TO 13 MAY, 2020)

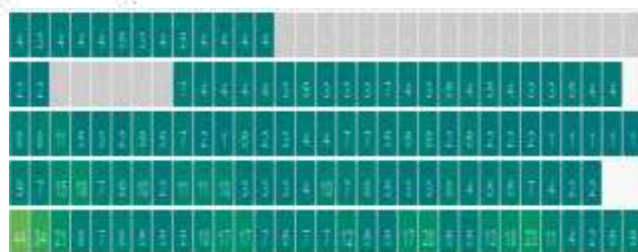


TABLE – 6 (a):MONTH WISSE AMBIENT AIR QUALITY- CO (1 January TO 13 MAY, 2020)

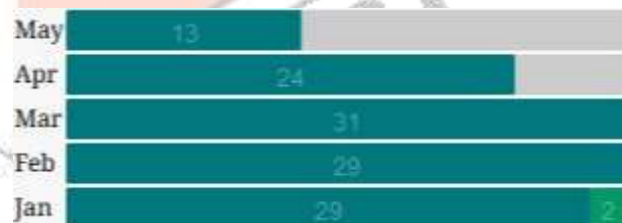


TABLE – 6 (b):MONTH WISE SCALE OF AMBIENT AIR QUALITY – CO (1 January TO 13 MAY, 2020)

Month	No. of Days									
	0-25	25-50	50-75	75-100	100-125	125-150	150-175	175-200	200-300	300-400
May	13									
Apr	24									
Mar	31									
Feb	29									
Jan	29	2								

Tables – 6, a, and b show there is a cut in carbon monoxide (CO) concentration from 41 on the 1<sup>st</sup> January to 1 on the last week of March, when lockdown was announced and carbon monoxide pollution indicator oscillated between 2 and 7 during the lockdown period of April and May.

## 6. Findings

Satellite-based findings, some ground-based weather observation systems have also reported a significant decrease in particle pollution over north India during the lockdown period. The foregoing analysis reveals that there has been dramatic reduction in PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>2</sub>, SO<sub>2</sub>, CO, O<sub>3</sub>, and other pollutant levels during the lockdown period not only in the study area or Delhi but also the whole of India. The silver lining of the Covid is that the lockdown has knocked down the pollution pervaded everywhere. Hence, the Air Quality Index (AQI) for India is showing a dramatic improvement in air quality and substantial drop in the air pollution. The observations are similar to the satellite-based findings and some ground-based weather observation systems which are reporting a significant decrease in particle pollution over critically polluted areas in India during the lockdown period.

## 7. Conclusion

It can be concluded that as it observed, there has been a significant reduction in pollution levels during the lockdown period. The lockdown is working as a panacea or a magic potion in getting rid of the pollution woes of India. It's a better opportune time for the policy makers and the environmentalists to give a fresh look with novel approach to sustain air quality in future.

## 8. References

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