27 April 2020 Madhav Rangrass and Devanshi Singh

# Impact of COVID-19 and the Lockdown on Air Pollution in the National Capital Region

## Introduction

According to the Central Pollution Control Board (**CPCB**), the nationwide 'Janta Curfew' on 22 March 2020 and the lockdown imposed since 24 March 2020 to combat the coronavirus outbreak have resulted in a significant improvement in air quality in India, especially in regions that are typically considered pollution hotspots. This is because 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 operation, landfill fires, etc. also contribute to air pollution. As a result of the lockdown, the stringent travel restrictions and shutting down of non-essential activities (including most of the aforementioned activities and other air polluting sectors), the air quality in many cities and towns across the country has improved.

This improvement is evidenced by the fact that government data shows that **across India the average concentration of PM 2.5 - one of the key polluting particles - plunged by 71% in a week, falling from 91 µg/m3 on 20 March 2020 to 26 µg/m3 on 27 March 2020**. Additionally, in Delhi a substantial improvement in air quality has been observed during the first week of the lockdown with a 35-40% reduction in PM2.5 and PM10 levels. This is evidenced by the fact that though PM2.5 levels fell by only 8% on the day of the curfew (22 March 2020), it fell by a much larger 34% the next day due to negligible combustion activities in and around the city. Similarly, PM10 levels fell by approximately 44% between 22 March 2020 and 23 March 2020.

The hourly data analysis by the CPCB shows a consistent decrease in concentration values starting 10.00 am onwards on the 22 March 2020. PM10 and PM2.5 levels dropped as low as 67 µg/m3 and 34 µg/m3 at 05.00 pm. The reduction in the number of on-road vehicles resulted in a **51% reduction in NOx levels** and **32% reduction in CO levels during 22-23 March 2020** as compared to 21 March 2020. The location specific data analysed by the CPCB reveals that during the period of 22-23 March 2020 the maximum reductions of (*a*) 48% for PM10 was observed at Mundaka & Alipur stations (*b*) 32% for PM2.5 at Narela

station (*c*) 74% for NOx at Pusa station, and (*d*) 67% for CO at Dwarka Sector 8 station. Given that Pusa and Dwarka are residential cum institutional sites with substantial traffic movements, the sharp decline in NOx and CO levels here was due to traffic restrictions.

According to a study conducted by TERI & ARAI, 2018, during summers, dust & construction activities (35%), transport sector (20%) and industrial activity (20%) are the major sources of PM2.5 in Delhi (**Sources of PM2.5**). With regard to PM10, dust & construction activities (43%), industrial activity (20%) and transport (17%) are the major contributing sources (**Sources of PM10**). Considering that overall, across the NCR between the period of 20 March 2020 to 30 March 2020, air quality monitoring data reveals that PM10 and PM2.5 levels fell by about 35 to 40%, as per the CPCB this may be explained as possible reduction from industries (~10%; considering continued operation of power plants with ~7–8% share, conversion of industries to natural gas, etc.), transport (~15%; with essential service vehicles and a small part of the fleet still plying on roads), and dust (~10-15%; with continued contribution due to soil and wind-blown dust because of high surface winds). There may be some reduction from other activities such as refuse burning, airport, etc. as well.

However, the aforementioned CPCB analysis only considers pollution related data for a period of approximately 10 days – 20 March 2020 to 30 March 2020. In this article, we have conducted a brief analysis of data generated from continuous ambient air quality monitoring stations in the national capital region (**NCR**) for a period of almost 2 months to see the long-term effects of the lockdown orders on the level of air pollution and AQI.

## Data Analysis

To conduct our analysis and ascertain the impact of the lockdown on air quality across the NCR, we have used the data generated by monitoring stations across Delhi, Uttar Pradesh, Haryana and Rajasthan. The data for this analysis has been taken from the CPCB's Continuous Ambient Air Quality Monitoring System, which tracks real-time data from 126 monitoring stations across India. The data has been analysed over a period extending from 4 March 2020 to 20 April 2020, randomly selecting one day every week. We have analysed data pertaining to (*a*) the level of PM2.5 and PM10 polluting particles in the air and (*b*) AQI levels. Additionally, we have also briefly analyzed the change in AQI levels across India every third day between 18 March 2020 and 29 March 2020, on the basis of the data made available by CPCB via its publication titled "*Impact of Janta Curfew & Lockdown on Air Quality*" dated 31 March 2020.

Across the NCR, we witnessed a fall in pollution levels after the announcement of the first phase of the lockdown on 24 March 2020. This was followed by a sharp rise in pollution levels across the NCR around 15 April 2020, the time when the first phase of the lockdown ended. Subsequently, after the

announcement of the second phase of the lockdown, the pollution levels have consistently dropped again from 15 April 2020 to 20 April 2020.

1. **Delhi**

For Delhi, we have analysed the data from 5 different monitoring stations - one each in north, south, east, west and central Delhi - that were showing comparatively higher readings of PM2.5, PM10 and AQI over the aforementioned period.

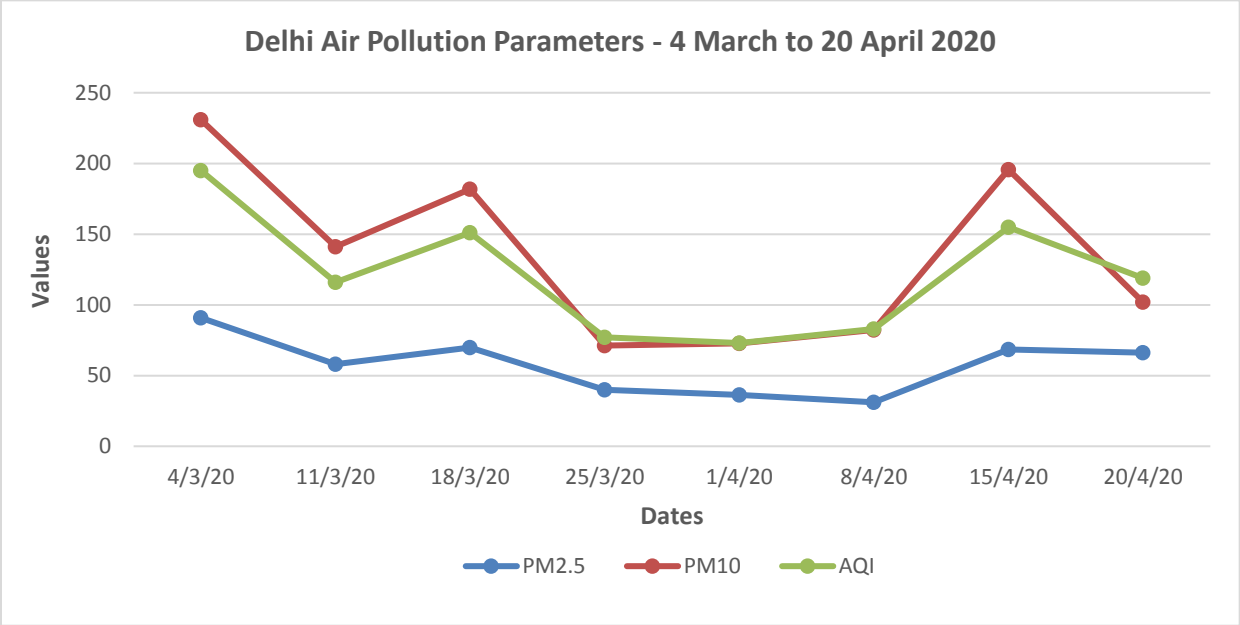


Figure 1

*Source: Central Control Room for Air Quality Management, CPCB*

The above data shows that between March and April 2020, the level of PM2.5 particles fell from a high of 90.82 µg/m3 on 4 March 2020 (2 weeks before the start of the lockdown) to a low of 31.11 µg/m3 on 8 April 2020 (2 weeks after the start of the lockdown), **recording a decline of 65.75%**. In the same period, the level of PM10 particles fell from a high of 230.86 µg/m3 on 4 March 2020 to a low of 71.23 µg/m3 on 25 March 2020, **a decline of 69.15%**. Additionally, the AQI readings fell from a high of 195 on 4 March 2020 to a low of 73 on 1 April 2020, **recording a decline of 62.56%**. Post this, especially during the start of the second phase of the lockdown, all three parameters peaked on 15 April 2020, recording levels of 68.41 µg/m3 (PM2.5), 195.7 µg/m3 (PM10) and 155 (AQI), **more than double of their respective minimums**. This increase was likely observed due to an increase in vehicular movement and the simultaneous rise in pollution levels

in the NCR territories surrounding Delhi, where certain industrial activities were restarted in anticipation of the lockdown ending.

## 2. NCR

To ascertain the impact of the lockdown within the entire NCR, it is also important to analyse the data available at monitoring stations located at various critical points outside Delhi but within the NCR territories falling within the states of Rajasthan, Haryana and Uttar Pradesh.

a. Rajasthan – Bhiwadi

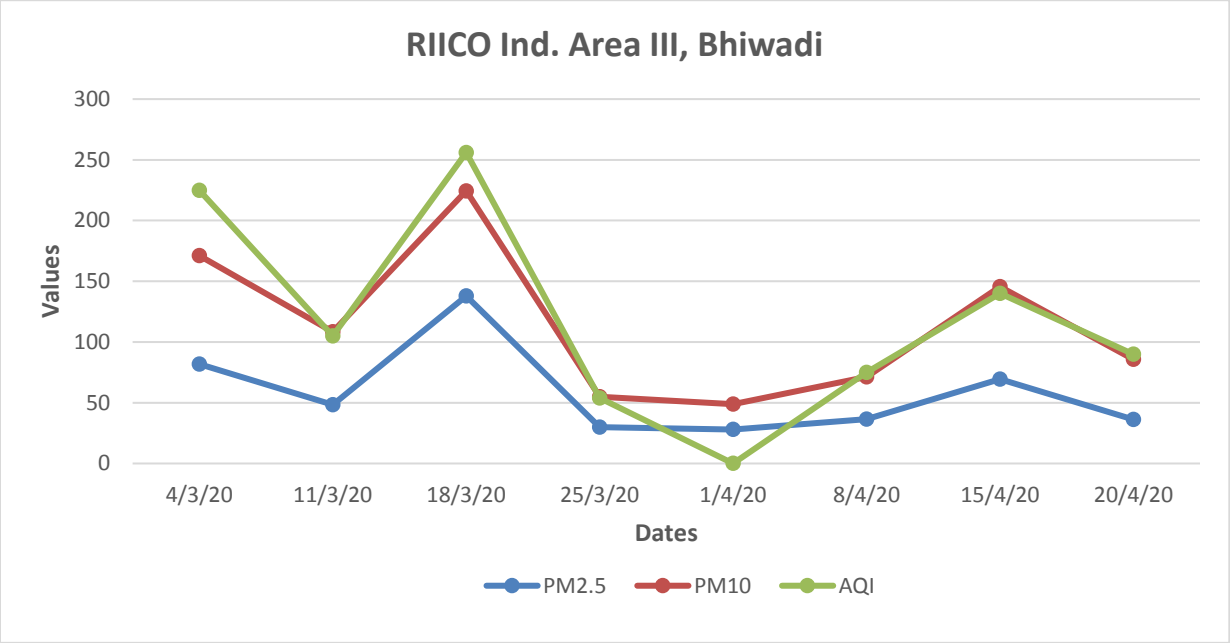


Figure 2[1]

*Source: Central Control Room for Air Quality Management, CPCB*

From the above visualisation, it can be observed that the level of PM2.5 which was as high as 137.85 µg/m3 on 18 March 2020 (before the lockdown orders) declined drastically to 29.7 µg/m3 on 25 March 2020, further down to 27.94 µg/m3 on 1 April 2020 which is 15 days post the lockdown**, a decline of 79.7% in 15 days**. For PM10, the decline took place from the level of 224.47 µg/m3 on 18 March 2020 to 48.83 µg/m3 on 1 April 2020, a decline of 78.2%. The AQI changed from 'Poor' category to 'Satisfactory' category between 18 March 2020 to 8 April 2020. However, an increase is observed in the levels of PM2.5, PM10 and AQI between 1 April 2020

[1] Values represented as "zero" are unavailable for that day.

and 15 April 2020, probably because of increased vehicular movement, localised combustion activities, industrial activities, meteorological factors, and the anticipation of the lockdown ending. Post the announcement of the second phase of the lockdown, the fall in pollution was observed again, indicating the lockdown having a positive impact on the air quality.

b. Haryana – Panipat

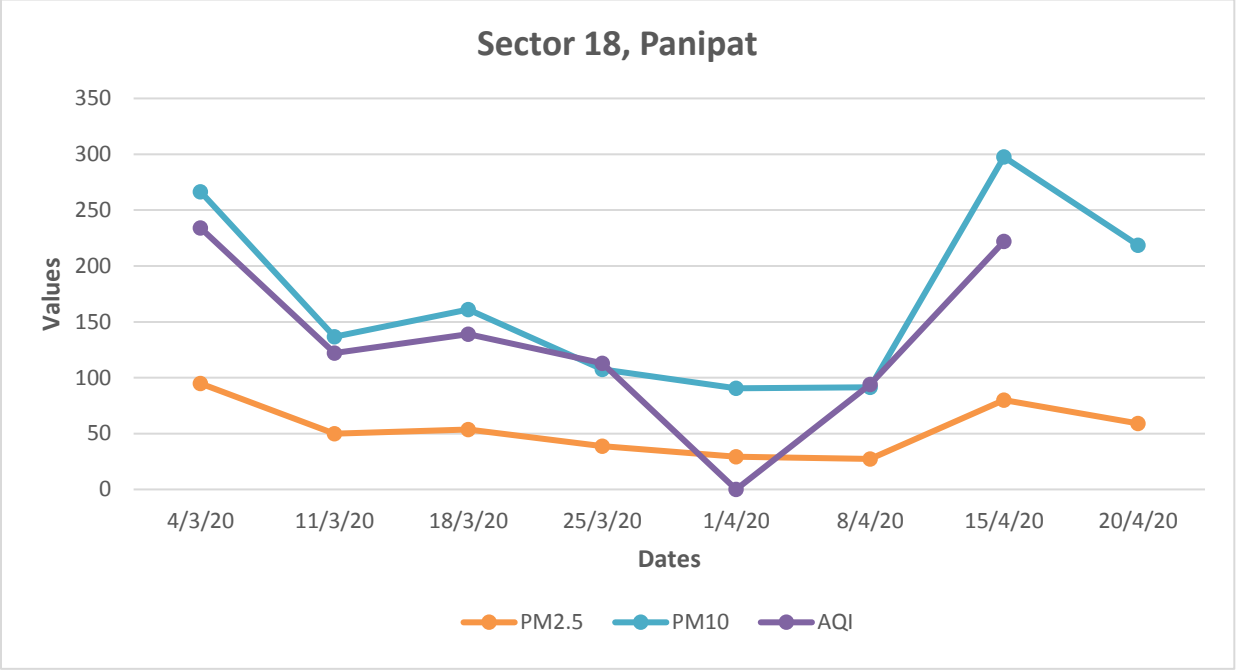


Figure 3[2]

*Source: Central Control Room for Air Quality Management, CPCB*

From the above graph, it can be observed that the level of PM2.5 which was 53.72 µg/m3 on 18 March 2020 (before the lockdown orders) declined to 38.86 µg/m3 on 25 March 2020, further down to 29.16 µg/m3 on 1 April 2020 which is 15 days post the lockdown**, a decline of 45.7% in 15 days**. For PM10, the decline took place from the level of 160.97 µg/m3 on 18 March 2020 to 90.55 µg/m3 on 1 April 2020, a decline of 43.7%. The AQI changed from the 'Moderately Poor' category to 'Satisfactory' category between 18 March 2020 to 8 April 2020. However, an increase is once again observed in the levels of PM2.5, PM10 and AQI between 1 April 2020 to 15 April 2020, probably due to localised combustion activities and the phase one of the lockdown finishing. The fall was observed again on 20 April 2020, during the second phase of the lockdown indicating the lockdown had a positive impact on the air quality.

[2] Values represented as "zero" are unavailable for that day.

c. Uttar Pradesh – Anand Vihar, Hapur

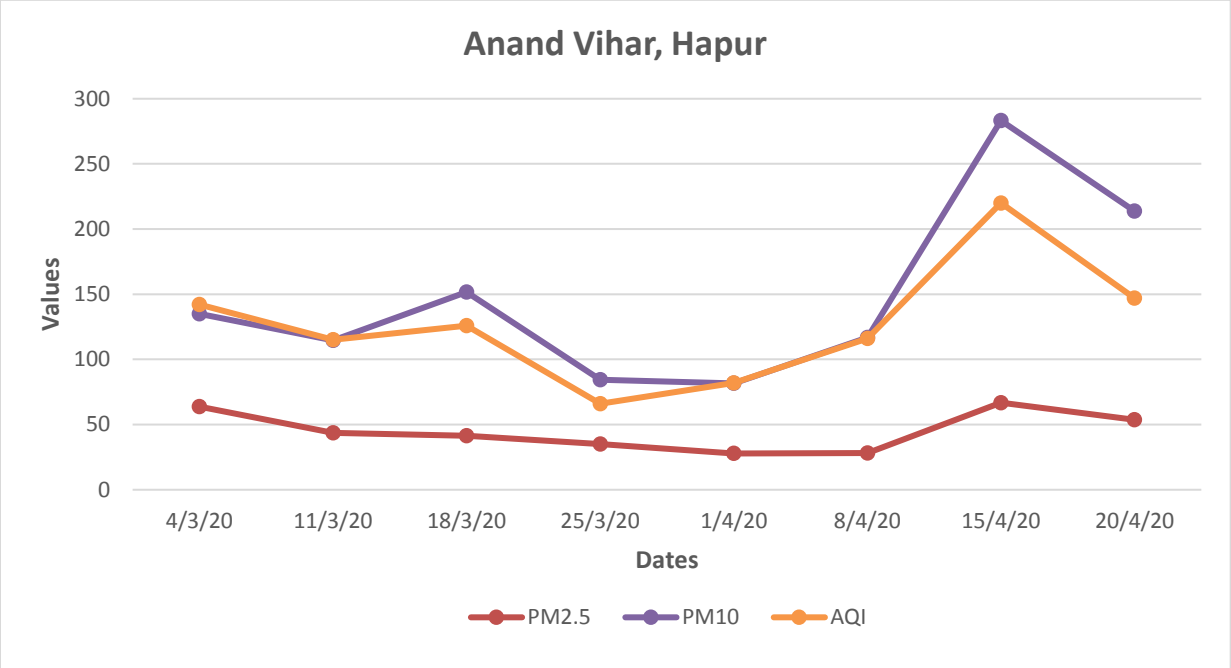


Figure 4

*Source: Central Control Room for Air Quality Management, CPCB*

The above data shows that the level of PM2.5 declined continuously the entire March due to restricted activities and stay home advisories, it was 41.48 µg/m3 on 18 March 2020 (before the lockdown orders) declined to 35.13 µg/m3 on 25 March 2020, further down to 27.83 µg/m3 on 1 April 2020 which was 2 weeks post the lockdown**, a decline of 33% in 15 days**. For PM10, the decline took place from the level of 151.72 µg/m3 on 18 March 2020 to 81.62 µg/m3 on 1 April 2020, a decline of 46%. The AQI changed from the 'Poor' category to the 'Satisfactory' category between 18 March 2020 to 1 April 2020. However, an increase is observed in the levels of PM2.5, PM10 and AQI between 1 April 2020 to 15 April 2020, probably due to localised combustion activities, vehicular movement, and the anticipated opening up orders. The fall was observed again between 15 April 2020 to 20 April 2020, during the second phase of the lockdown indicating the lockdown and restricted movement and industrial activities had a positive impact on the air quality.

## 3. Delhi - Comparing Data from 2017-2020

In addition to analysing data from key monitoring stations across the NCR between 4 March 2020 and 20 April 2020, we have also analysed the variation in PM2.5, PM10 and AQI levels in Delhi during the same period (i.e. 4 March to 20 April) in the years 2017, 2018 and 2019. This analysis is shown below and will give us a more accurate representation of the impact of the lockdown, when compared to pollution levels at the same time in previous years.

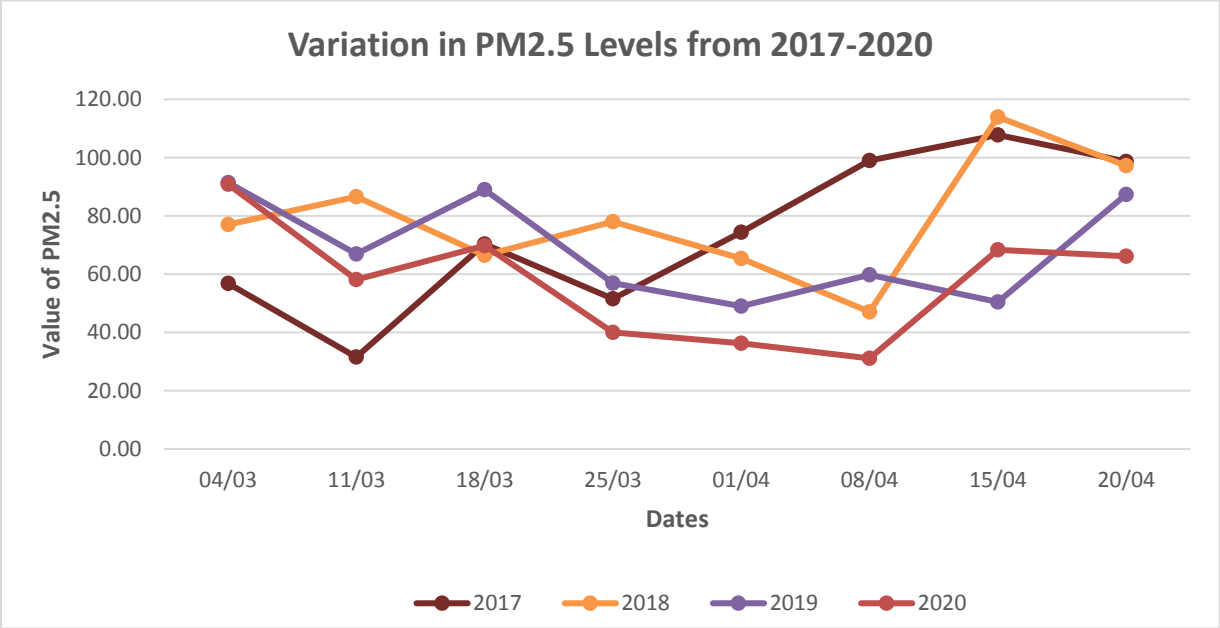


Figure 5

*Source: Central Control Room for Air Quality Management, CPCB*

The above graph shows that from 2017-2019, there was no conclusive trend in terms of an increase and/or decrease in PM2.5 levels between 4 March and 20 April. The **fall in PM2.5 levels during this period is the largest in 2020,** showing that the lockdown has had a positive impact on PM2.5 levels in Delhi. Further**, the maximum PM2.5 level during this period each year is the lowest in 2020** - reaching a maximum of 90.82 µg/m3 on 4 March 2020 (prior to the lockdown), **once again showing the positive impact of the lockdown**. This analysis is also supported by Figure 8 below, which shows that between **4 March and 20 April, the average PM2.5 levels have been lowest in 2020**.

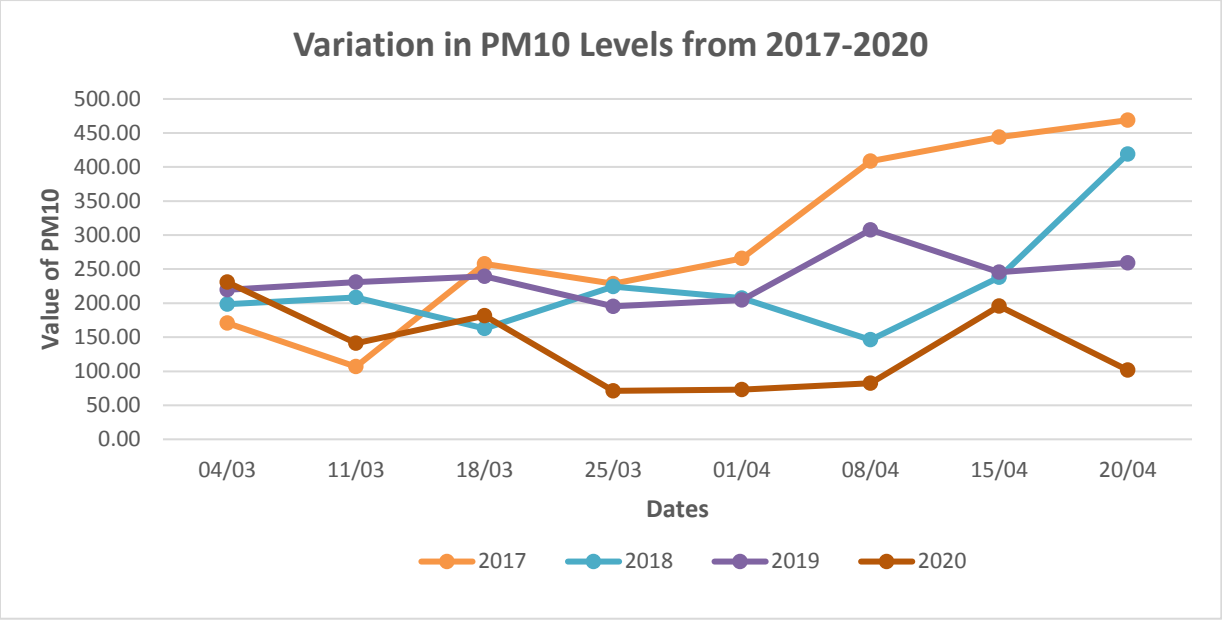


Figure 6

*Source: Central Control Room for Air Quality Management, CPCB*

The data for PM10 levels from 2017-2019, shows once again that there was no conclusive trend of an increase and/or decrease in PM10 levels between 4 March and 20 April. The **fall in PM10 levels during this period is the largest in 2020**. Further, the **maximum PM10 level during this period each year is the lowest in 2020** - reaching a maximum of 230.86 µg/m3 on 4 March 2020 (prior to the start of the lockdown, evidencing the positive impact of the lockdown on PM10 levels in Delhi. This analysis is also supported by Figure 8 below, which shows that **between 4 March and 20 April, the average PM10 levels are lowest in 2020**.

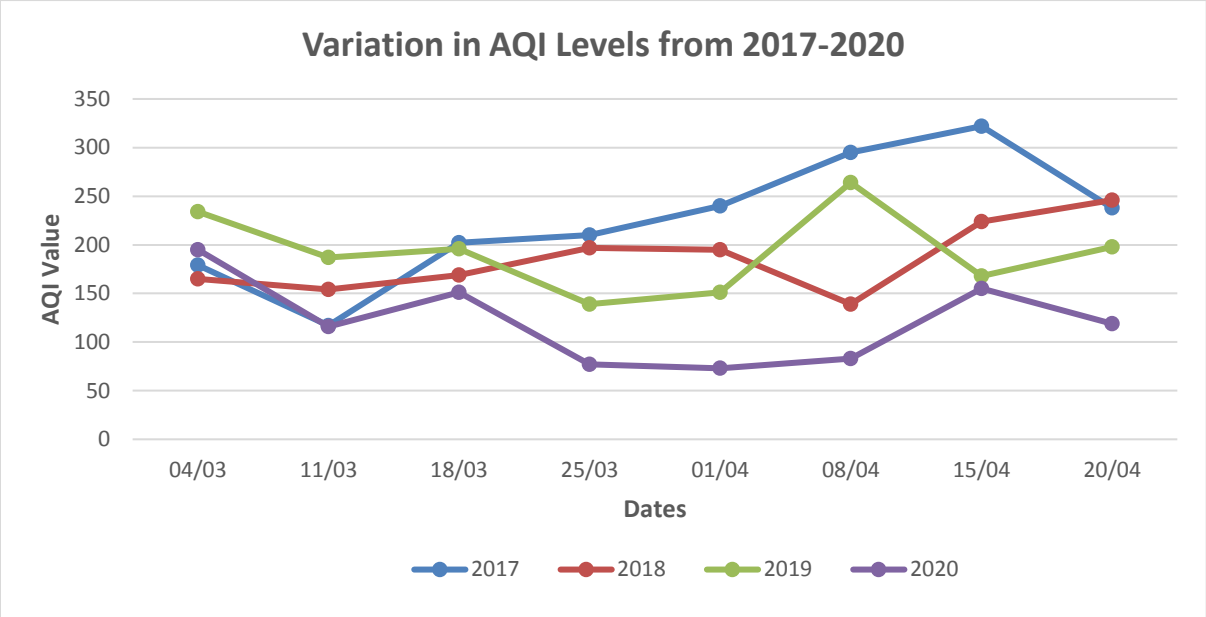


Figure 7

*Source: Central Control Room for Air Quality Management, CPCB*

The data for AQI levels from 2017-2019 do not follow any consistent trend between 4 March and 20 April. **The year 2020 has recorded the lowest AQI levels during this period and has also recorded the lowest maximum in AQI levels** – reaching a maximum of 195 on 4 March. This analysis is also supported by Figure 8 below, which shows that between 4 March and 20 April, **the average AQI levels are lowest in 2020**.

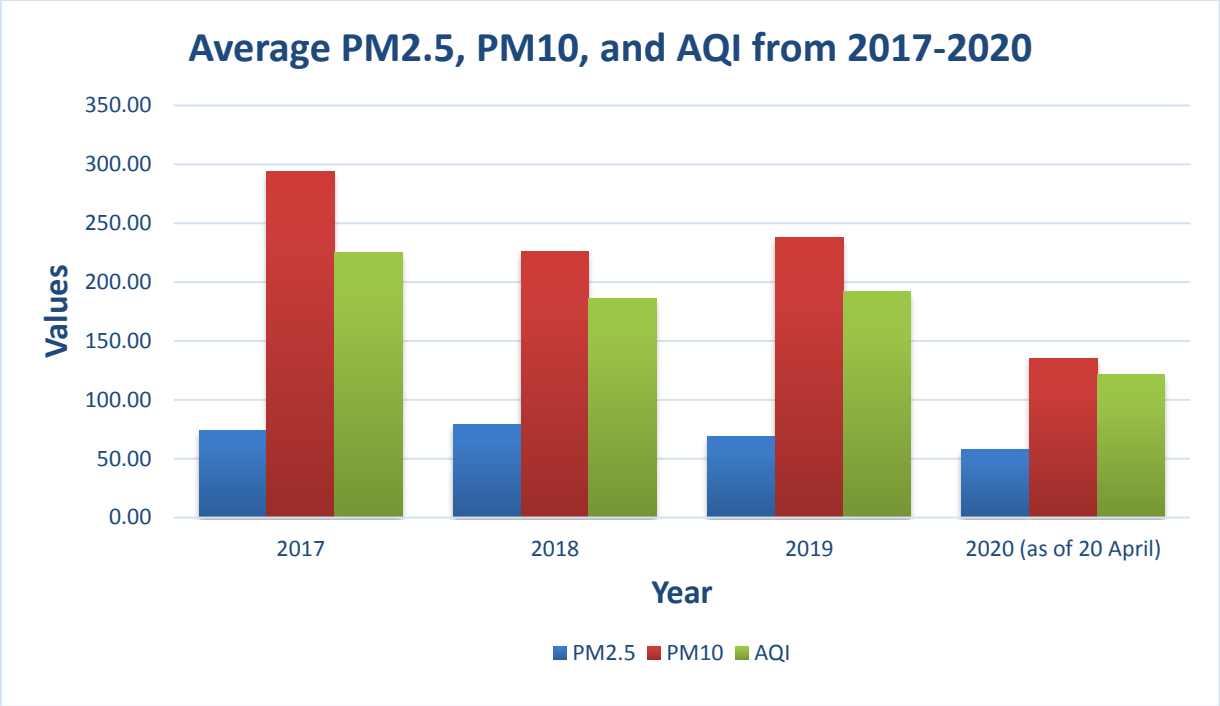


Figure 8

*Source: Central Control Room for Air Quality Management, CPCB*

## 4. Pan-India – Change in AQI Levels

Along with the reduction in pollution levels in the NCR region, AQI levels across India have also fallen during the lockdown. As shown in Figure 9 below, after the commencement of the lockdown, the number of cities in India falling within the lower AQI categories – 'Good' and 'Satisfactory' – has increased. The number of cities/towns across India in the **'Good' category** (with AQIs between 0-50), **has increased from just 3 cities/towns on 18 March 2020 to 30 cities/towns on 29 March 2020, an increase of 1000%**. Similarly, the number of cities/towns across India in the **'Satisfactory' category** (with AQIs between 51-100) has **increased from 42 on 18 March 2020 to 61 on 29 March 2020, an increase of 45.24%**. Perhaps the most significant change however is the reduction in the number of cities/towns across India falling within the higher 'Moderate' and 'Poor' AQI categories (with AQIs between 101-200 and 201-300 respectively). The number of cities/towns across India in the **'Moderate' category has reduced from 58 on 18 March 2020 to just 12 on 29 March 2020, a reduction of 79.31%**. Most importantly, the number of cities/towns across India in the **'Poor' category (or above) has reduced from 9 on 18 March 2020 to zero on 29 March 2020**.

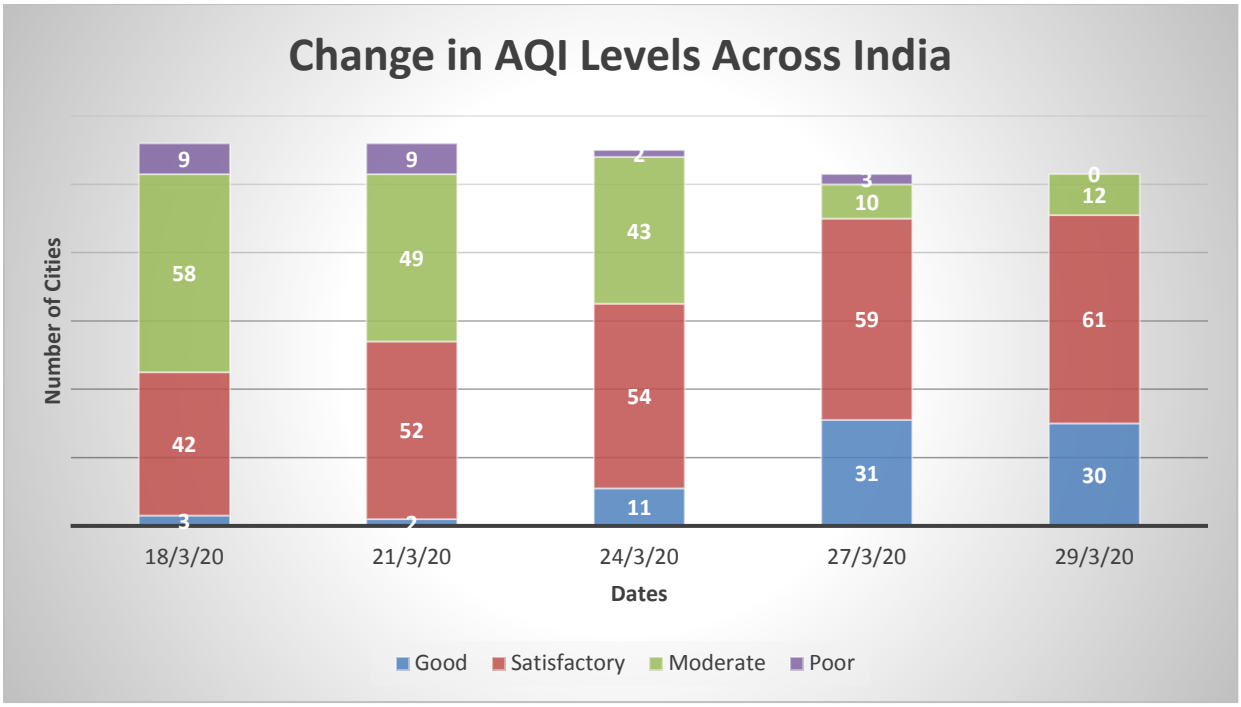


Figure 9

*Source: Impact of Janta Curfew & Lockdown on Air Quality, CPCB, 31 March 2020*

## Conclusion

The lockdown and its impact on the environment should serve as an experimental model for the government. It provides an opportunity to learn how the drastic reductions in emissions from various sectors impact the atmosphere. A substantial fall in deadly pollutants like PM2.5, PM10, NOx, CO and Ozone has been observed due to lockdown and confinement measures to control the outbreak of COVID-19. The current crisis has shown us that clear skies and breathable air can be achieved very fast if concrete action is taken collectively to combat the menace of air pollution. While the current situation will be difficult to sustain under normal circumstances, and it will be challenging for the government to implement such extreme measures once we are out of the current health emergency, the current situation and data can be used to conduct an in-depth study on the most effective measures to reduce pollution from the biggest sources. The model should be taken forward to trigger policy changes to clean the polluted air and combat climate change in the NCR.