

**Central Pollution Control Board**  
**(Ministry of Environment, Forest and Climate Change)**  
**Govt. of India, Delhi**

## **IMPACT OF JANTA CURFEW & LOCKDOWN ON AIR QUALITY**

**31<sup>st</sup> MARCH, 2020**

The nationwide Janta Curfew on March 22, 2020 and lockdown since March 24, 2020, have 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. 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. As a result of stringent travel restrictions and shutting down of non essential activities including those of air polluting sectors, air quality improvement has been noted in many towns and cities across the nation. A brief analysis of data generated from continuous ambient air quality monitoring network and findings are summarized in this report.

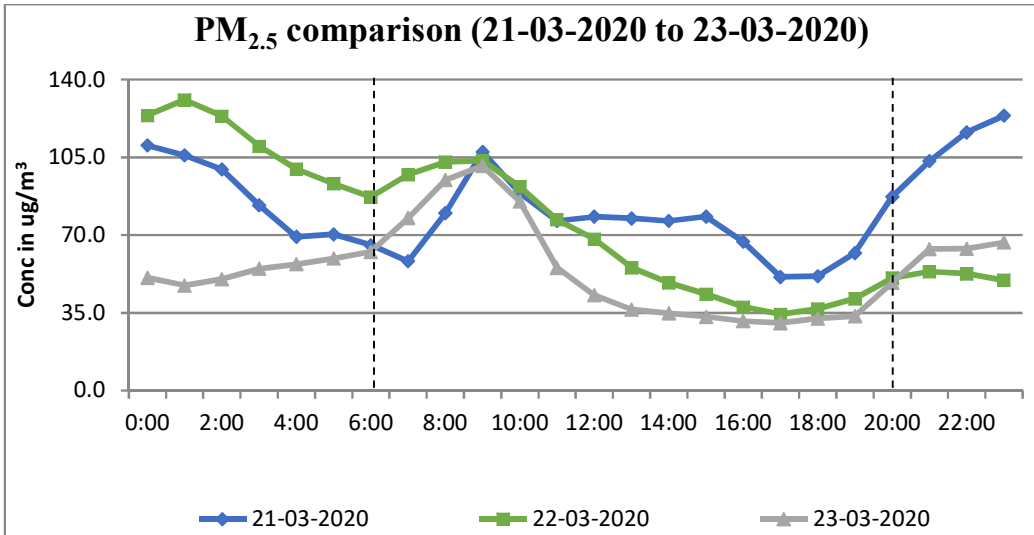
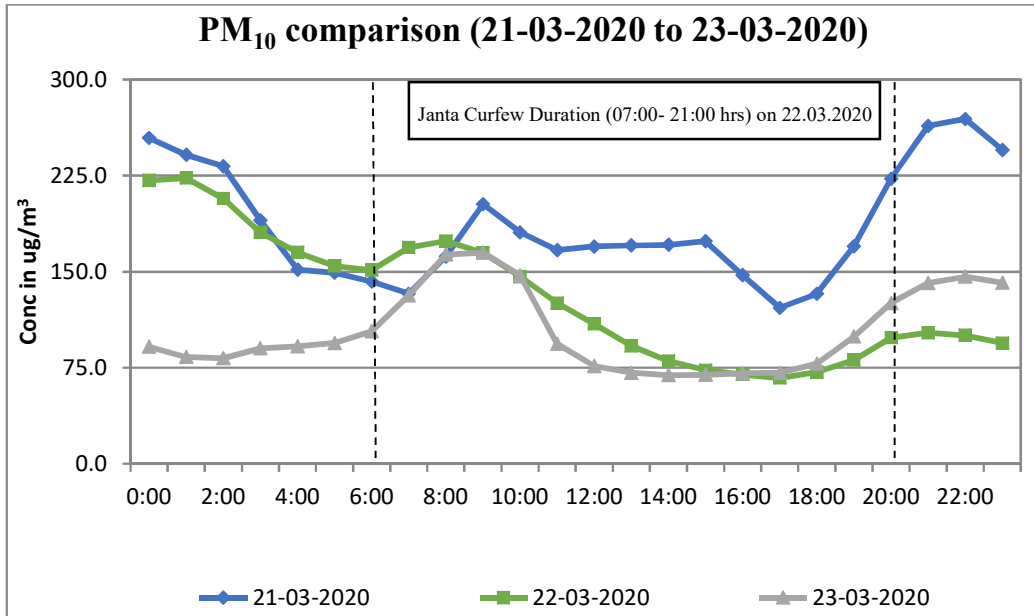
### **EFFECT OF JANTA CURFEW IN DELHI**

On the day of Janta Curfew, as a result of combination of reduced vehicles on the road, functioning of only essential commercial units and prevailing weather conditions, a significant reduction was noted for PM<sub>10</sub> and NO<sub>x</sub> levels. On March 21, 2020, AQI was 'Moderate' in Delhi which gradually improved from higher to lower end of the category. Overall, up to 44% reduction in PM<sub>10</sub> levels was observed in Delhi during March 22-23, 2020 compared to previous day. The PM<sub>2.5</sub> reduction was though 8% on the curfew day but declined to 34% next day owing to negligible combustion activities on March 22-23, 2020 in and around the city. The hourly data analysis reveals a consistent decrease in concentration values starting 10.00 am onwards on the day of Janta Curfew. PM<sub>10</sub> and PM<sub>2.5</sub> levels dropped as low as 67 µg/m<sup>3</sup> and 34µg/m<sup>3</sup> at 05.00 pm.

The reduction in number of on-road vehicles, resulted in up to 51% reduction in NO<sub>x</sub> levels and 32% reduction in CO levels during March 22-23, 2020 as compared to March 21, 2020.

The location specific data analysis reveals that maximum reductions of 48% for PM<sub>10</sub> was observed at Mundaka & Alipur, 32% for PM<sub>2.5</sub> at Narela, 74% for NO<sub>x</sub> at Pusa and 67% for CO at Dwarka Sector 8 station. It is to be noted that Pusa and Dwarka are residential cum institutional sites with substantial traffic movements, thus sharp decline in NO<sub>x</sub> and CO levels further affirm that traffic restrictions were instrumental in improving air quality.

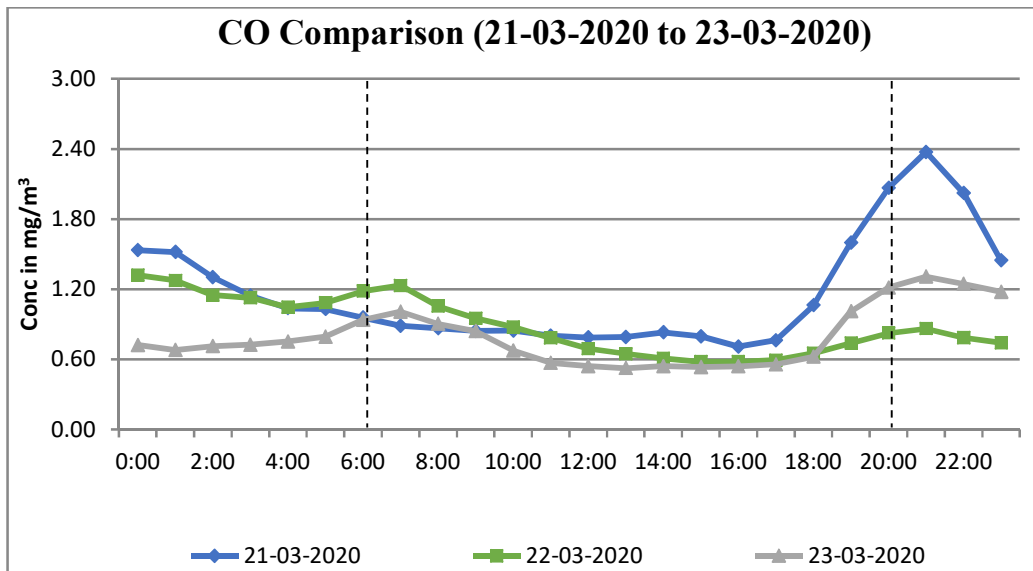
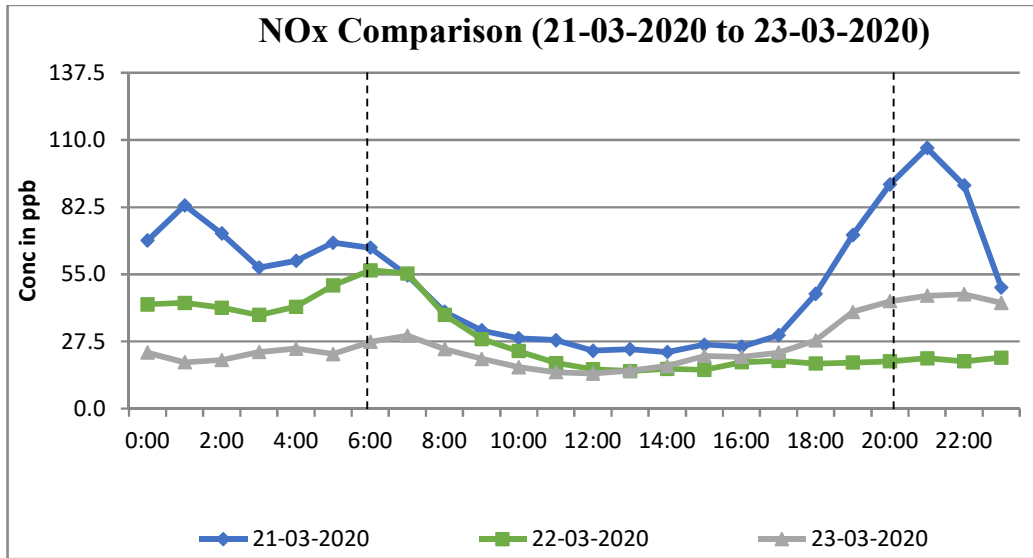
The graphs below depict hourly concentration trend for PM<sub>2.5</sub> and PM<sub>10</sub>, for pre hours (00:00 Hrs to 06:00 Hrs) and curfew period (07:00 Hrs to 21:00 Hrs) for 21<sup>st</sup> (pre curfew), 22<sup>nd</sup> (curfew) and 23<sup>rd</sup> (post curfew) March 2020.



The hourly comparison of average concentration values shows a clear declining trend in levels of PM<sub>10</sub> and PM<sub>2.5</sub> during March 21-23, 2020. On March 21, 2020 the maximum value of PM<sub>10</sub> was 269 µg/m<sup>3</sup> at 22:00 Hrs, which dropped to 100 µg/m<sup>3</sup> on March 22, 2020. Similarly, the lowest concentration observed on March 21, 2020 at 17:00 Hrs was 121.8 µg/m<sup>3</sup>, which dropped to 67 µg/m<sup>3</sup> on March 22, 2020. The drop in coarse particles may be attributed to restriction on construction activities, less road dust resuspension and to some extent curb on industrial activities. A similar and

clear decline was seen for PM<sub>2.5</sub> with concentration value falling from 130.9 µg/m<sup>3</sup> at 01:00 Hrs (before start of curfew period) to a minimum value of 34.3 µg/m<sup>3</sup> at 17:00 Hrs during curfew hours, further dropping to 30.4 µg/m<sup>3</sup> on March 23, 2020. The absence of non-essential vehicles and combustion activities in industrial and commercial sites during the period is attributable to the decline.

The graphs below depict hourly concentration trend for NO<sub>x</sub> and CO for pre hours (00:00 Hrs to 06:00 Hrs) and curfew period (07:00 Hrs to 21:00 Hrs) for the period 21<sup>st</sup> to 23<sup>rd</sup> March, 2020.



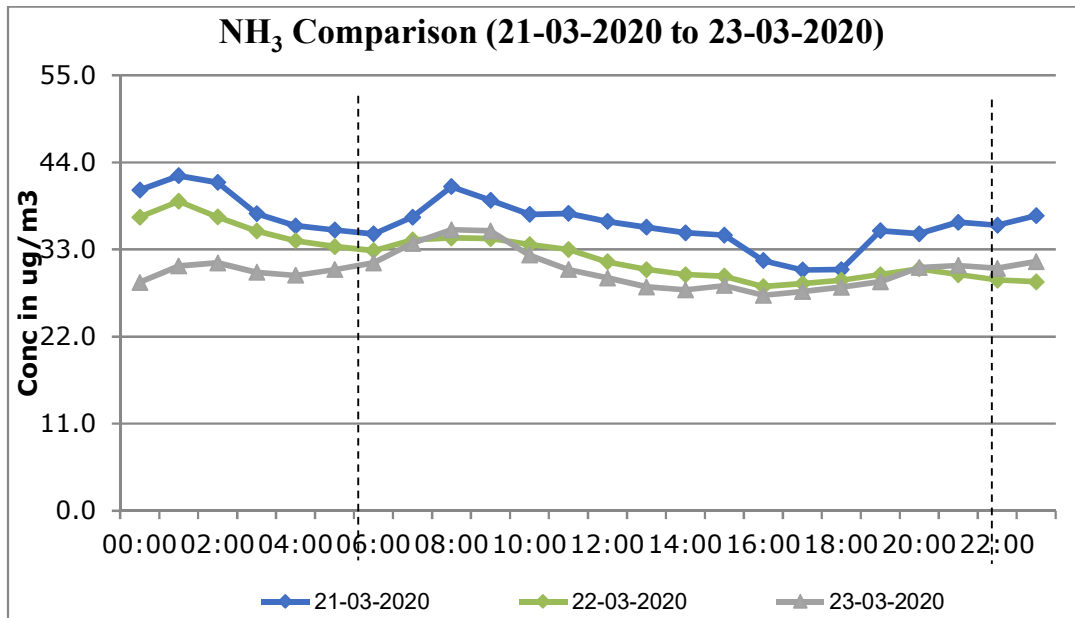
Hourly NO<sub>x</sub> and CO values on March 22, 2020 remained mostly below the hourly values observed on March 21, 2020. The peak value of NO<sub>x</sub> on March 21, 2020 was almost five times higher than the value observed on March 22, 2020. Similar trend was observed for CO. The routine diurnal varia-

tion of  $\text{NO}_x$  and CO is twin-crested with a larger crest during night hours. However, notably on the day of the Janta curfew, the night crest is negligible, highlighting the absence of vehicular emissions.

It is important to mention here, the impact of meteorological factors was partially favourable, with mixing height of 2900m on March 22, 2020 higher than previous (2500m) and post curfew day (800m). Wind speed was slightly higher on March 22, 2020 (2.3m/s) as compared to post curfew day (1.5 m/s). The ventilation coefficient on day of curfew was  $1856 \text{ m}^2/\text{s}$ , thus the reduction in air pollution can be largely attributed to transport & commercial-industrial restrictions.

As reported in source apportionment study conducted by TERI & ARAI, 2018, during summers, dust & construction activities (35%), transport sector (20%) and industry (20%), are major source of  $\text{PM}_{2.5}$  in Delhi. With regard to  $\text{PM}_{10}$ , dust & construction activities (43%), industry (20%) and transport (17%) are major contributing sources. As result of complete restrictions on non-essential vehicular movement and commercial activities, the emissions from construction activities and industries were stopped. The on-road vehicles were relatively sparse compared to normal days thus contribution from road dust resuspension & transport sector was much reduced. A broad analysis is attempted to explain the improved air pollution levels due to lockdown. Air quality monitoring data reveal that during lockdown period  $\text{PM}_{10}$  and  $\text{PM}_{2.5}$  levels were reduced by about 35 to 40%, which 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.), and transport (~15%; with essential service vehicles and a small part of 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.

This analysis is further affirmed on examining the trend for ammonia concentration during the curfew period. Since major sources of ammonia in Delhi originate from decomposition of organic matter (sewage, solid waste dumps, etc.), the reduction in concentration was not as significant as that observed for other pollutants. This is evident by the fact that on the day of curfew, only 12% reduction in Ammonia levels were observed in Delhi. The peak value on March 21, 2020 was only 8% higher than maximum value noted on March 22, 2020. Though, hourly  $\text{NH}_3$  values on March 22, 2020 remained below hourly values observed on March 21, 2020. The data trend for ammonia is as presented below,



### EFFECT OF JANTA CURFEW IN OTHER NCR TOWNS

The air pollution reduction trend in NCR towns was relatively less pronounced compared to NCT of Delhi. While, reduction in PM<sub>10</sub> levels were observed on March 22, 2020 in all neighbouring towns except Gurgaon, PM<sub>2.5</sub> levels remained high, showing only slight reduction in Noida (6%) and Ghaziabad (9%), this can be attributed to localized combustion activities in NCR towns. Similarly, while significant reduction in NO<sub>x</sub> levels was observed in Noida (55%), Ghaziabad (51%), the same was not noted in Gurugram (4%) and Faridabad, where NO<sub>x</sub> emissions were found higher during early hours of curfew signifying higher vehicular movement during that period. The levels tapered off as day progressed. A similar trend was noted for CO emissions. The impact of curfew restrictions was more apparent on next day i.e. on March 23, 2020 as compared to pre curfew levels on March 21, 2020.

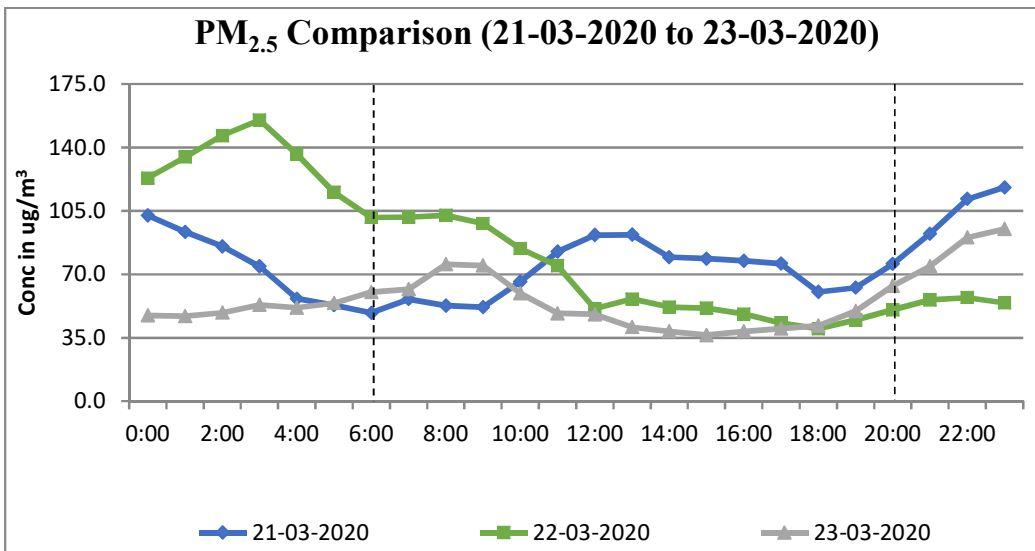
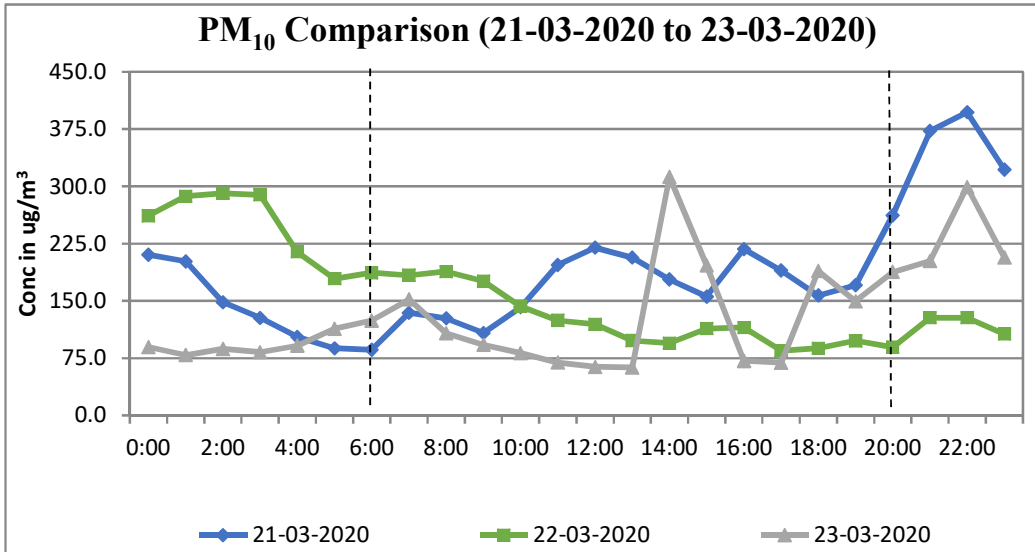
The trends for neighboring NCR towns are presented in detail in subsequent paras,

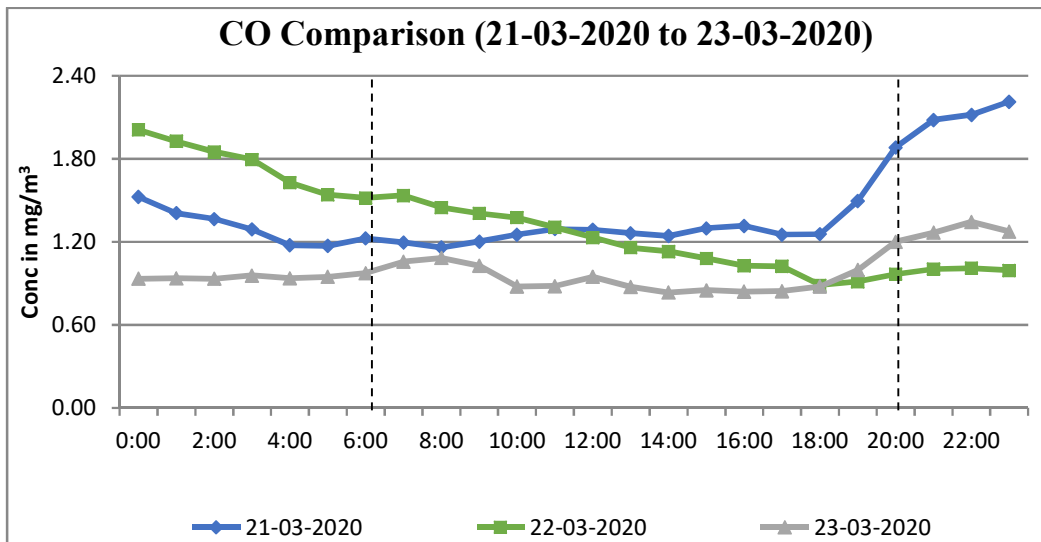
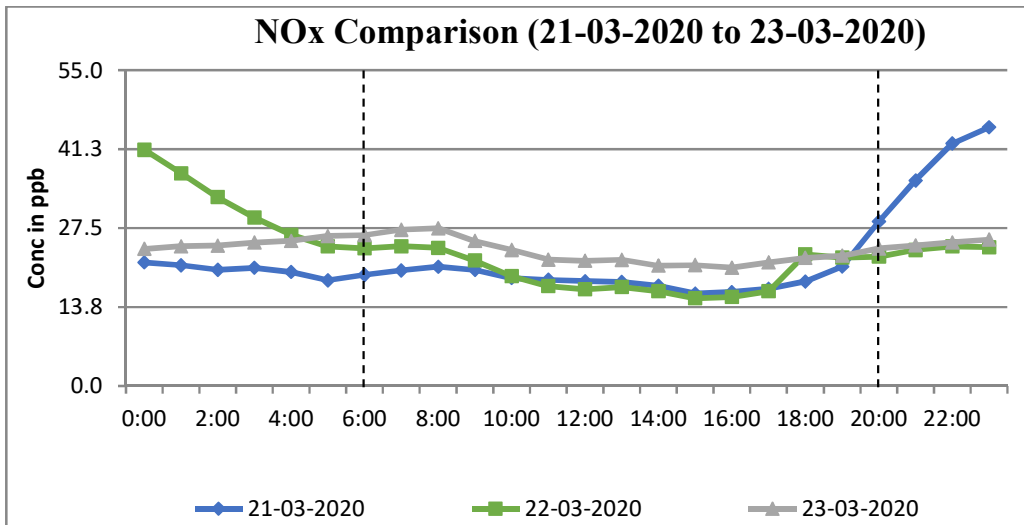
#### Faridabad

The impact of restrictions was visible in Faridabad from afternoon hours. The early hours (07:00 - 10:00 Hrs.) showed high PM, NO<sub>x</sub> & CO concentrations, which gradually reduced as day progressed. This may be attributed to high vehicular movement presumably of private vehicles during early hours. PM<sub>2.5</sub>, CO and NO<sub>x</sub> increased slightly during evening (18:00Hrs), seemingly due to increase in vehicular movement. Overall, significant reduction was noticed in PM<sub>10</sub> and CO emissions, while PM<sub>2.5</sub> emissions reduced gradually from early peak. No significant reduction was noted for

NOx emissions, in all probability due to localized combustion activities and shutdown operations of industrial units in anticipation of lockdown.

The data trends for Faridabad is as presented below,

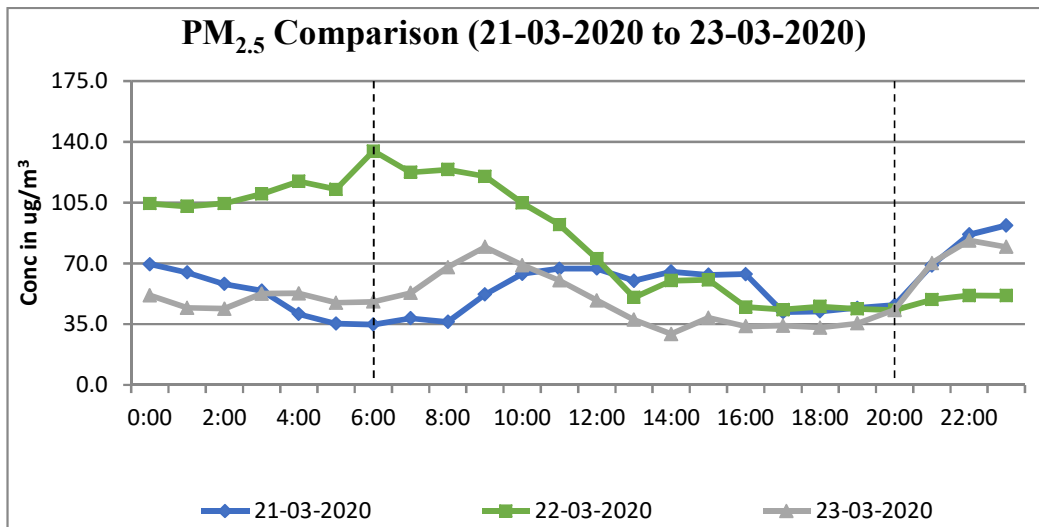
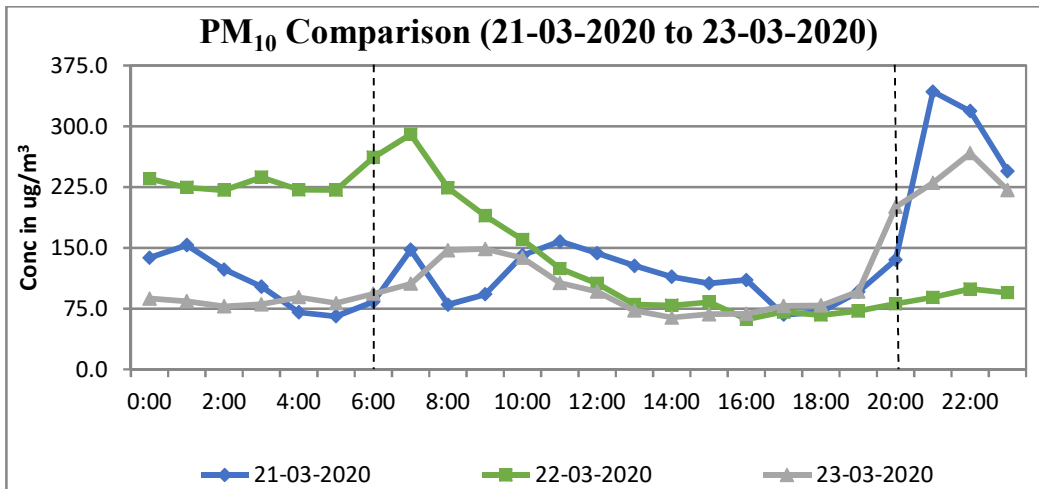




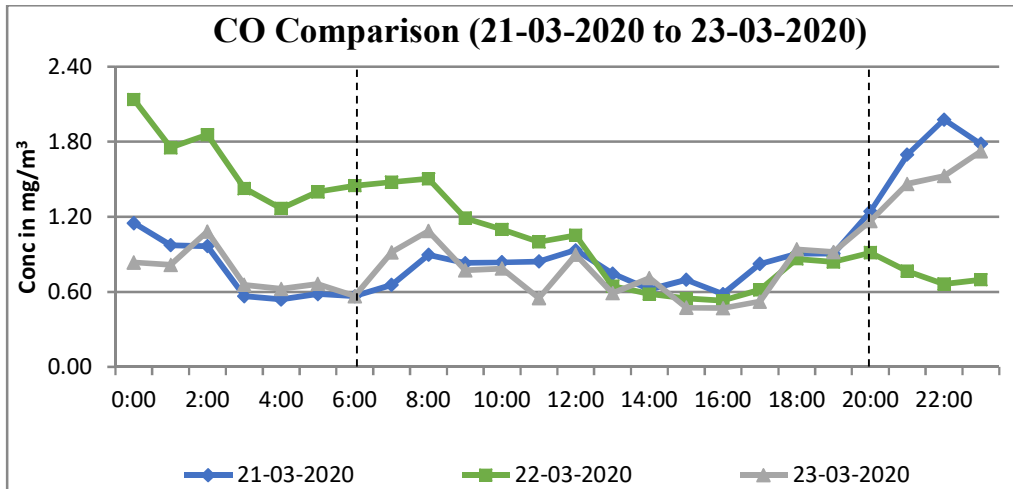
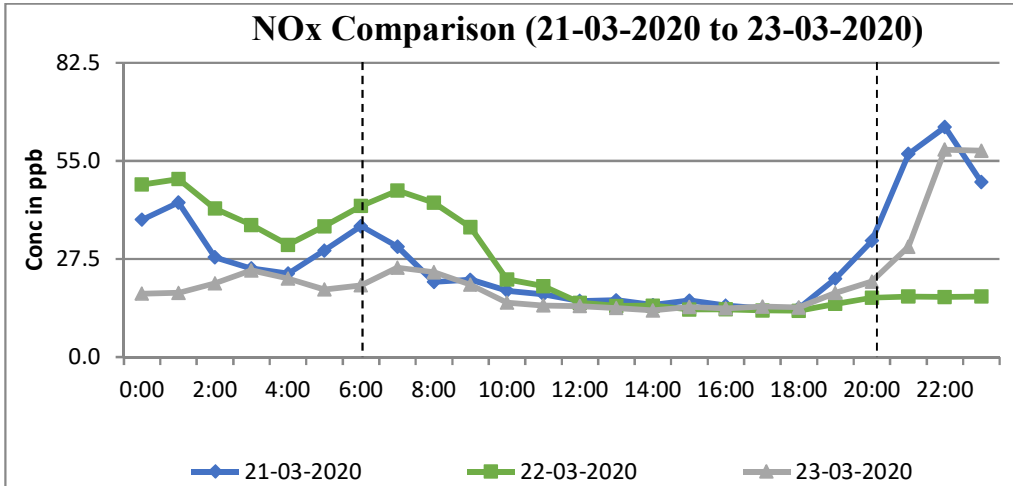
### Gurugram

The overall reduction in PM, NOx & CO emission levels was less pronounced in Gurugram on the day of Curfew. One of the factor being cumulative effect of higher emissions levels from previous day March 21, 2020 (18:00 - 23:00 Hrs). However, hourly data reveals a declining trend in pollutant levels from 07:00 Hrs onwards on the day of curfew. Thus, the higher 24 hourly average is attributable to higher levels in the early morning hours. Further, dust & construction activities contribute 49% to PM<sub>2.5</sub> and 52% to PM<sub>10</sub> in Gurugram, it is likely that road dust resuspension due to vehicle restrictions might have come down resulting in lower emissions as day progressed which continued till 18:00 Hrs on March 23, 2020 (with exception of early morning peak for PM<sub>2.5</sub>).

The data trend for Gurugram is as presented below,

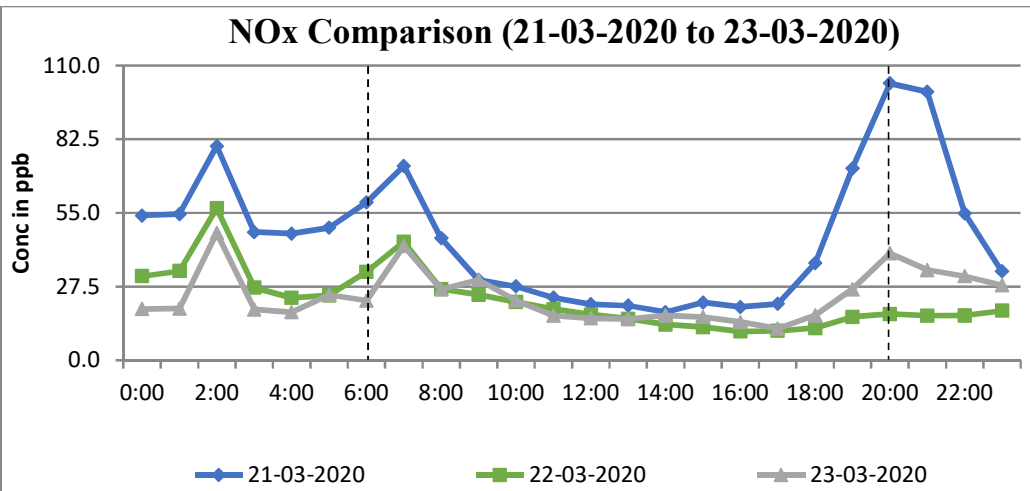
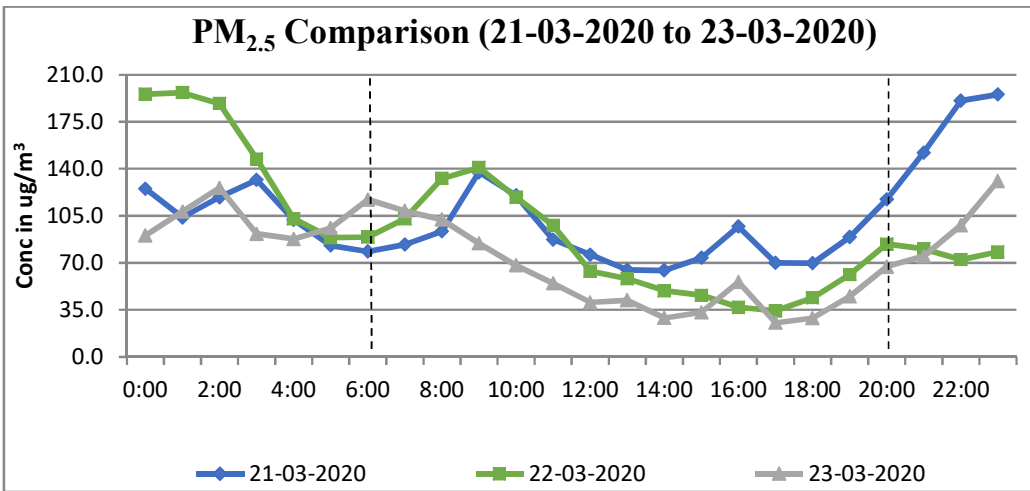
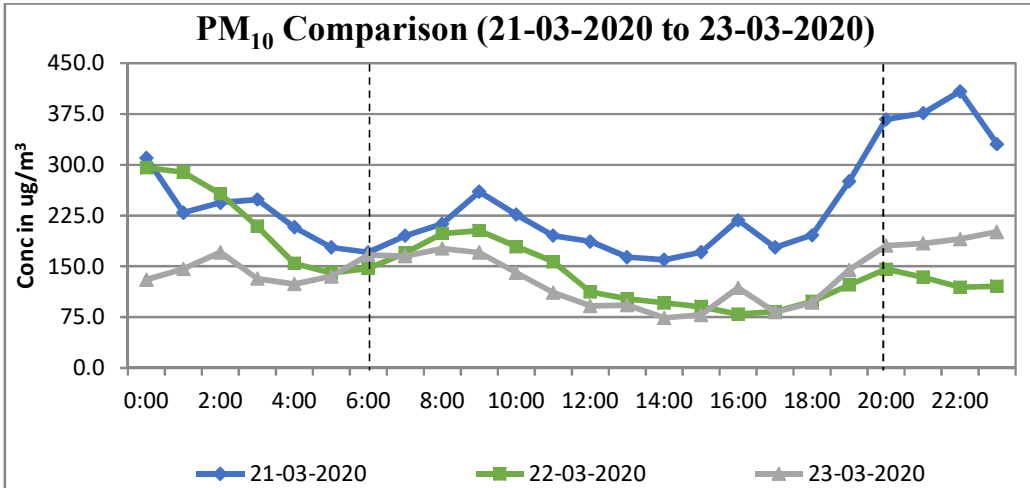


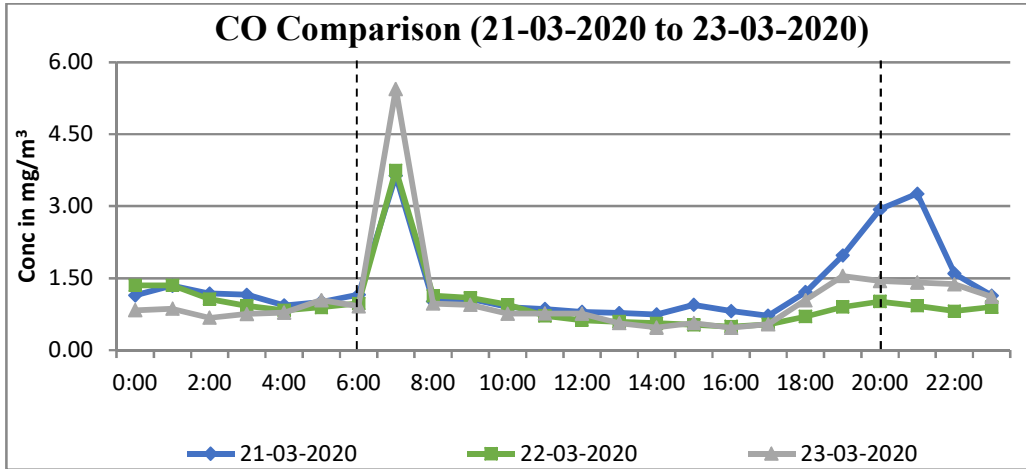




Ghaziabad

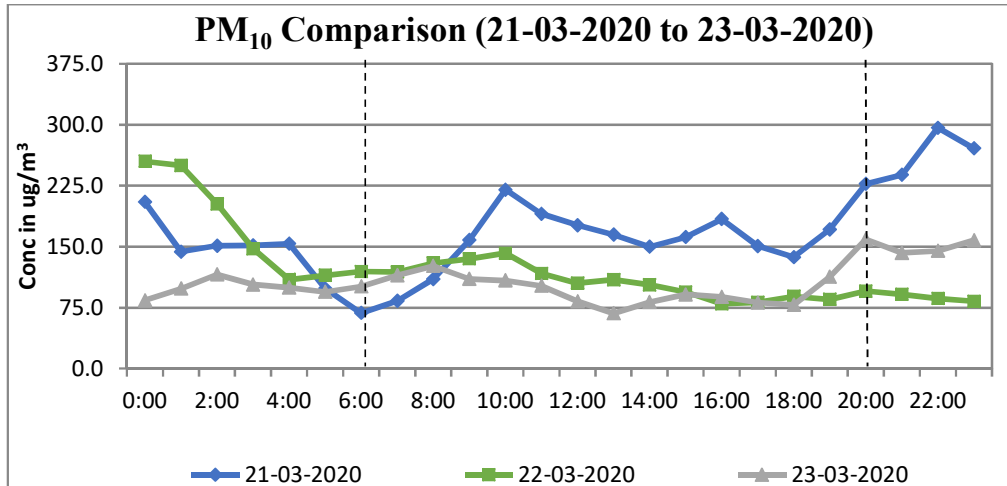
Emission levels were observed high during early morning hours seemingly due to cumulative effect of previous night accumulation of pollutants and early morning vehicular emissions on the day of curfew. The levels were considerably reduced post 09:00Hrs. However, emission levels slightly increased during night hours (21:00 Hrs) as vehicular movement increased.

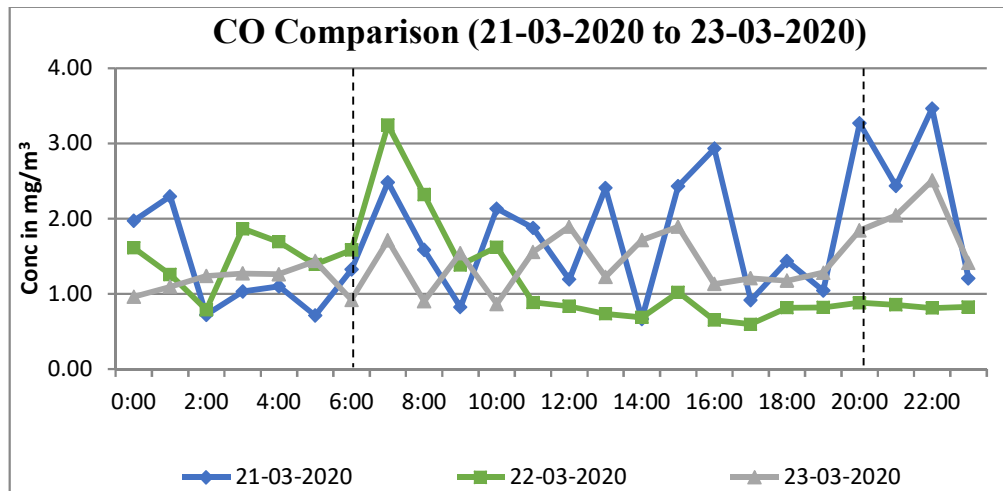
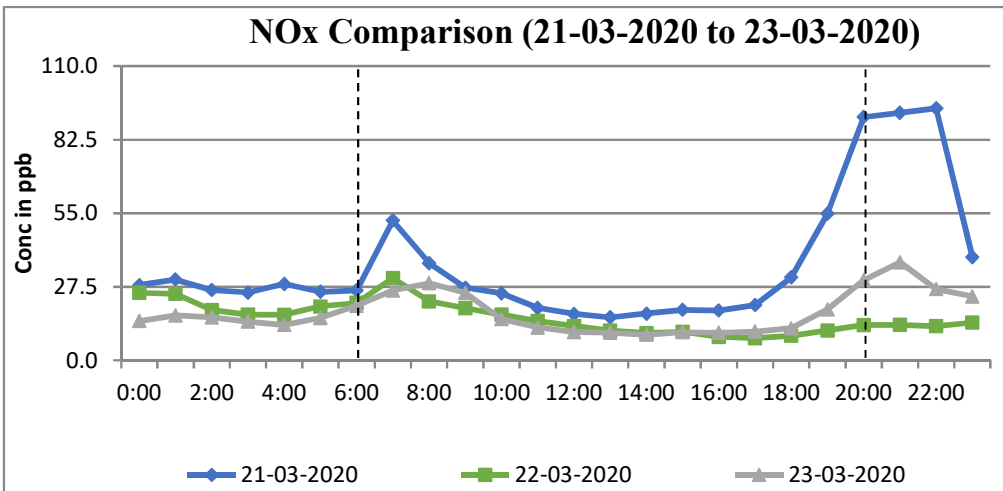
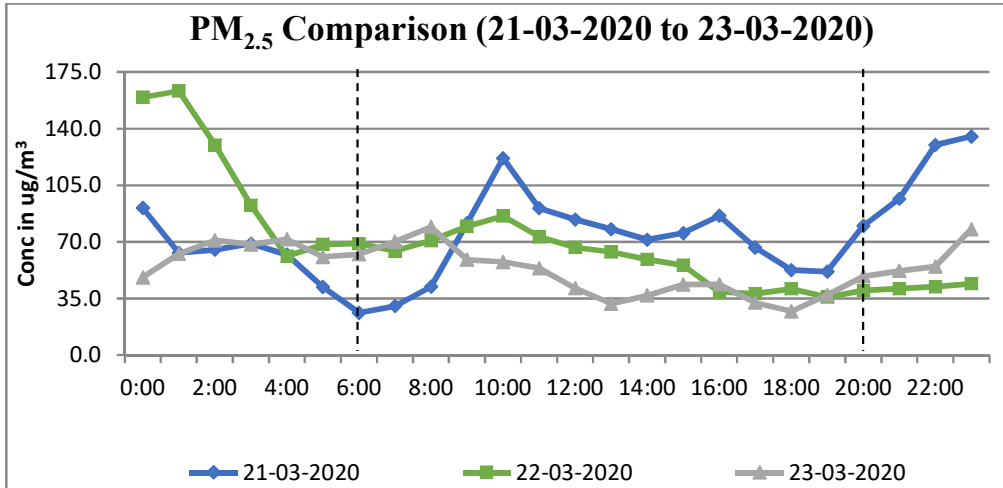




Noida

Positive effects of curfew on air pollution levels were observed in Noida, as emission levels considerable reduced from previous night peaks. PM<sub>10</sub> was significant reduced, suggesting reduced contribution of road dust resuspension & C & D activities. The PM<sub>2.5</sub>, NO<sub>x</sub> and CO emission levels were higher on curfew day than previous day during morning hours signifying contribution of combustion activities. However, the same decreased gradually as day progressed and meteorological conditions improved.





## EFFECT OF LOCKDOWN IN DELHI NCR

Substantial improvement in air quality of Delhi NCR is noted during the lockdown period, as the major contributing sources to PM & NO<sub>x</sub> emissions (prominent pollutants in Delhi NCR) have been restricted. The AQI in Delhi NCR was under ‘moderate’ category on March 23, 2020 at start of lockdown period, with exception of Gurugram which recorded AQI under ‘Satisfactory’ category. As days progressed, under cumulated effect of restricted vehicle movement & commercial activities and increased mixing height, the AQI improved to ‘Satisfactory’ category. On March 26, 2020, high surface winds (25 kmph) maintained AQI category even though mixing height dropped to 1100 m. Next day, though wind speed and mixing height were reduced to half value, AQI value improved further and Gurugram recorded ‘Good’ AQI category. During March 28- 29, 2020 as wind speed and mixing height increased, AQI value improved further, with Delhi, Ghaziabad and Noida recording ‘Good’ AQI category on March 28, 2020.

Date	Surface wind speed (kmph)	Mixing height (m)	Delhi	Faridabad	Gurugram	Ghaziabad	Noida
23.03.2020	10	800	124	130	91	159	123
24.03.2020	10	2700	122	187	127	166	130
25.03.2020	12	2500	77	100	69	86	80
26.03.2020	25	1100	92	88	61	84	72
27.03.2020	15	500	69	75	42	72	60
28.03.2020	14	2250	45	64	54	39	38
29.03.2020	20	2600	62	83	62	48	58

## EFFECT OF JANTA CURFEW & LOCKDOWN IN OTHER CITIES

The improvement in air quality of 85 cities was noted as most of the vehicles remained off road and non-essential industrial units closed during Janta Curfew and national wide lockdown. Most of the million plus population cities, which have high population density and substantial share of

emissions from transport sector, showed improvement in air quality levels. Indo gangetic cities showed significant improvement in AQI values with levels moving from higher to lower end of category and 17 cities moving in 'Satisfactory' category and 07 cities in 'Good' category. The AQI value in coastal areas was slightly improved though not as significantly as noted for Indo gangetic plains. On the day of curfew, Chennai and Mumbai remained in 'Satisfactory' category, however a slight increase in AQI value was noted in Chennai on the next day, possibly due to local contribution. Higher AQI value was seen in Kanpur with PM<sub>2.5</sub> as prominent pollutant, likely emanating from local combustion sources. The positive impact on air quality was not observed significantly in industrial cities. High AQI value was noted in Vapi, Ratlam (SO<sub>2</sub> as prominent pollutant), Satna, Singrauli and Chandrapur seemingly due emissions from industrial areas. Overall, Janta Curfew resulted in general improvement in air quality across the country with quantum of improvement being varied based on local contribution sources., though regional contribution was largely absent. A detailed data sheet on AQI values for March 22 - 23, 2020 for 102 cities is placed at Annexure I.

The real time air quality data from CAAQM stations in 115 cities was examined for March 16 - 29, 2020 to assess impact of lockdown period. During start of pre lockdown period on March 16, 2020, 55 cities were under 'Good' & 'Satisfactory' AQI categories, as days progressed the number of cities under 'Good' & 'Satisfactory' categories started to decrease with more cities moving in 'Moderate' category. The pattern continued till March 21, 2020. The situation changed on March 22, 2020, on the day of Janta Curfew 67 cities recorded 'Good' & 'Satisfactory' AQI values. The trend has continued since then, with increasing number of cities recording 'Good' AQI value. As on March 29, 2020, a total 91 cities were under 'Good' & 'Satisfactory' category, with 31 cities with 'Good' AQI values. However, Lucknow, Muzaffarpur, Kalyan, Guwahati & Singrauli were under 'Poor' category during March 25-28, 2020. High emission levels in Lucknow & Guwahati were noted for PM<sub>2.5</sub>, which can be attributed to local combustion related activities. High PM<sub>10</sub> emission levels were observed in Singrauli, the road dust resuspension due to gusty winds may be a contributing factor.

As on March 29, 2020 no city is under 'Poor' AQI category. The date wise AQI is given in Annexure II.

**Comparative AQI Status – 22nd March, 2020 at 7am (Before Start of Janta Curfew)  
and 23rd March, 2020 at 7am (capturing impact due to Janta Curfew)**

S. No.	State	City	AQI on 22 <sup>nd</sup> March, 2020 at 7am (Janta Curfew imposed)	AQI on 23 <sup>rd</sup> March, 2020 at 7am	Change on 23 <sup>rd</sup> in comparison to 22 <sup>nd</sup> March, 2020
1	Andhra Pradesh	Amaravati	32	52	20
2		Rajamahendravaram	44	53	9
3		Tirupati	44	48	4
4	Assam	Guwahati	218	231	13
5	Bihar	Gaya	83	116	33
6		Muzaffarpur	179	146	-33
7		<b>Patna</b>	<b>213</b>	<b>149</b>	<b>-64</b>
8	Chandigarh	<b>Chandigarh</b>	<b>69</b>	<b>38</b>	<b>-31</b>
9	Delhi	<b>Delhi</b>	<b>192</b>	<b>117</b>	<b>-75</b>
10	Gujarat	<b>Ahmedabad</b>	<b>138</b>	<b>113</b>	<b>-25</b>
11		Ankleshwar	84	82	-2
12		Gandhinagar	88	87	-1
13		Nandesari	128	124	-4
14		Vapi	84	105	21
15		Vatva	120	119	-1
16	Haryana	Ambala	103	72	-31
17		Bahadurgarh	179	133	-46
18		Bhiwani	94	76	-18
19		Dharuhera	148	133	-15
20		<b>Faridabad</b>	<b>199</b>	<b>107</b>	<b>-92</b>
21		Fatehabad	94	80	-14
22		Gurugram	151	125	-26
23		Hisar	98	96	-2
24		Kaithal	104	60	-44
25		Karnal	202	90	-112
26	Kurukshetra	151	55	-96	

S. No.	State	City	AQI on 22 <sup>nd</sup> March, 2020 at 7am (Janta Curfew imposed)	AQI on 23 <sup>rd</sup> March, 2020 at 7am	Change on 23 <sup>rd</sup> in comparison to 22 <sup>nd</sup> March, 2020
27		Palwal	169	132	-37
28		Panchkula	75	65	-10
29		Panipat	236	120	-116
30		Rohtak	155	130	-25
31		Sirsa	74	65	-9
32		Sonipat	163	115	-48
33		Yamunanagar	112	69	-43
34	Karnataka	Bagalkot	109	70	-39
35		<b>Bengaluru</b>	<b>88</b>	<b>63</b>	<b>-25</b>
36		Chikkaballapur	98	83	-15
37		Hubballi	79	61	-18
38		Mysuru	49	39	-10
39		Ramanagara	60	45	-15
40		Vijayapura	70	95	25
41	Yadgir	74	56	-18	
42	Kerala	Eloor	71	69	-2
43		Ernakulam	62	51	-11
44		Kannur	73	61	-12
45		Kochi	78	44	-34
46		Kozhikode	57	38	-19
47		Thiruvananthapuram	58	53	-5
48	Madhya Pradesh	<b>Bhopal</b>	<b>148</b>	<b>99</b>	<b>-49</b>
49		Damoh	99	70	-29
50		Dewas	115	109	-6
51		<b>Gwalior</b>	<b>92</b>	<b>86</b>	<b>-6</b>
52		<b>Indore</b>	<b>137</b>	<b>110</b>	<b>-27</b>
53		<b>Jabalpur</b>	<b>96</b>	<b>78</b>	<b>-18</b>
54		Katni	99	68	-31
55		Maihar	55	54	-1



S. No.	State	City	AQI on 22 <sup>nd</sup> March, 2020 at 7am (Janta Curfew imposed)	AQI on 23 <sup>rd</sup> March, 2020 at 7am	Change on 23 <sup>rd</sup> in comparison to 22 <sup>nd</sup> March, 2020
56		Mandideep	125	59	-66
57		Pithampur	129	103	-26
58		Ratlam	106	119	13
59		Sagar	78	63	-15
60		Satna	40	55	15
61		Singrauli	165	208	43
62		Ujjain	107	109	2
63	Maharashtra	<b>Aurangabad</b>	<b>75</b>	<b>66</b>	<b>-9</b>
64		Chandrapur	52	58	6
65		<b>Mumbai</b>	<b>60</b>	<b>60</b>	<b>0</b>
66		<b>Nagpur</b>	<b>58</b>	<b>38</b>	<b>-20</b>
67		Navi Mumbai	83	76	-7
68		<b>Pune</b>	<b>88</b>	<b>81</b>	<b>-7</b>
69		Solapur	98	70	-28
70		Thane	50	36	-14
71	Meghalaya	Shillong	83	37	-46
72	Punjab	<b>Amritsar</b>	<b>96</b>	<b>73</b>	<b>-23</b>
73		Bathinda	103	102	-1
74		Jalandhar	105	45	-60
75		Khanna	62	40	-22
76		<b>Ludhiana</b>	<b>94</b>	<b>37</b>	<b>-57</b>
77		Mandi Gobindgarh	101	55	-46
78		Patiala	76	56	-20
79		Rupnagar	98	49	-49
80	Rajasthan	Alwar	77	77	0
81		Ajmer	102	99	-3
82		Bhiwadi	201	127	-74
83		<b>Jaipur</b>	<b>89</b>	<b>72</b>	<b>-17</b>
84		<b>Jodhpur</b>	<b>136</b>	<b>107</b>	<b>-29</b>

S. No.	State	City	AQI on 22 <sup>nd</sup> March, 2020 at 7am (Janta Curfew imposed)	AQI on 23 <sup>rd</sup> March, 2020 at 7am	Change on 23 <sup>rd</sup> in comparison to 22 <sup>nd</sup> March, 2020
85		<b>Kota</b>	<b>80</b>	<b>89</b>	<b>9</b>
86		Pali	117	101	-16
87		Udaipur	75	47	-28
88	Tamil Nadu	<b>Chennai</b>	<b>62</b>	<b>68</b>	<b>6</b>
89	Telangana	<b>Hyderabad</b>	<b>107</b>	<b>67</b>	<b>-40</b>
90	Uttar Pradesh	<b>Agra</b>	<b>102</b>	<b>101</b>	<b>-1</b>
91		Bulandshahr	192	129	-63
92		<b>Ghaziabad</b>	<b>237</b>	<b>178</b>	<b>-59</b>
93		Greater Noida	234	115	-119
94		Hapur	189	111	-78
95		<b>Kanpur</b>	<b>76</b>	<b>113</b>	<b>37</b>
96		<b>Lucknow</b>	<b>127</b>	<b>121</b>	<b>-6</b>
97		<b>Meerut</b>	<b>223</b>	<b>125</b>	<b>-98</b>
98		Muzaffarnagar	140	84	-56
99		Noida	183	108	-75
100		<b>Varanasi</b>	<b>137</b>	<b>86</b>	<b>-51</b>
101		Howrah	78	42	-36
102		<b>Kolkata</b>	<b>63</b>	<b>38</b>	<b>-25</b>

- (-) indicate reduction in AQI or improvement in air quality
- Cities with **Bold Text** are cities with million plus population

**Comparative AQI Status from 16th March to 29 March, 2020  
(based on CPCB AQI Bulletin, published at 4 PM)**

Total Number of cities with CAAQM stations: 126 (as of 16th March 2020)

Date	No. of cities for which data is available	No. of cities in AQI category						No. of cities with AQI in range of Good to Satisfactory	No. of cities with AQI in Moderate Category	No. of cities with AQI in range of Poor to Severe
		Good	Satisfactory	Moderate	Poor	Very Poor	Severe			
16-Mar-20	108	6	49	50	3	0	0	55	50	3
17-Mar-20	111	3	44	59	5	0	0	47	59	5
18-Mar-20	112	3	42	58	9	0	0	45	58	9
19-Mar-20	115	3	39	65	8	0	0	42	65	8
20-Mar-20	115	2	51	50	12	0	0	53	50	12
21-Mar-20	112	2	52	49	9	0	0	54	49	9
22-Mar-20 (Janta Curfew)	114	9	58	39	8	0	0	67	39	8
23-Mar-20	108	10	63	33	2	0	0	73	33	2
24-Mar-20	110	11	54	43	2	0	0	65	43	2
<b>National Lockdown in effect due to COVID-19 Pandemic</b>										
25-Mar-20	104	14	67	21	2	0	0	81	21	2
26-Mar-20	102	21	64	14	3	0	0	85	14	3
27-Mar-20	103	31	59	10	3	0	0	90	10	3
28-Mar-20	101	35	57	8	1	0	0	92	8	1
29-Mar-20	103	30	61	12	0	0	0	91	12	0

AQI Category	AQI Range	Associated Health Impact
<b>Good</b>	0-50	Minimal Impact
<b>Satisfactory</b>	51-100	Minor breathing discomfort to sensitive people
<b>Moderate</b>	101-200	Breathing discomfort to the people with lungs, asthma and heart diseases
<b>Poor</b>	201-300	Breathing discomfort to most people on prolonged exposure
<b>Very Poor</b>	301-400	Respiratory illness on prolonged exposure
<b>Severe</b>	401-500	Affects healthy people and seriously impacts those with existing diseases

