Pandemic and a Dip in Air Pollution

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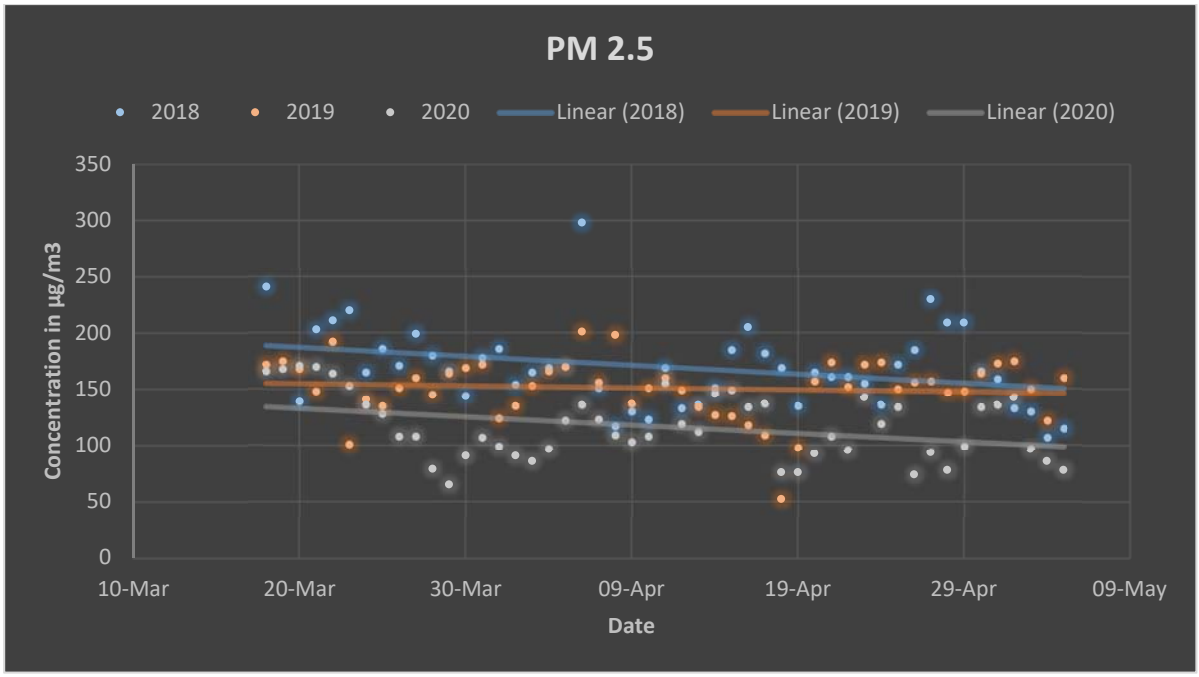
The coronavirus pandemic and ensuing lockdowns, which began taking effect from early March at the global level have resulted in sudden disruption of transport and industrial activity along with almost whole of social and economic life. The lockdowns have been done to contain the spread of the virus as well as gain time for ramping up coping strategies and mechanisms to manage health and economic hazards caused by the pandemic. The large scale curtailment of industrial activity has provided a window to register the effect of vehicular and industrial pollution on urban life. Dip in pollution levels have been reported from every part of the world implementing a lockdown. Some prominent names in the list of cities which have witnessed a drastic decrease in pollution are from China, western Europe and the Indian subcontinent.

To understand the change in the air quality of Delhi, ambient air quality data collected by the Delhi Pollution Control Committee (DPCC) at National Institute of Malaria Research (NIMR). Sector-8, Dwarka Delhi has been analysed. The twenty-four-hour average concentration of six primary air pollutants i.e. PM2.5, PM10, Ozone (O_3), Nitrogen Dioxide (NO_2), Sulphur Dioxide (SO_2) and Carbon Monoxide (CO), as collated by the World Air Quality Project, has been compared for 7 weeks between 18 March and 05 May over three years, 2018, 2019 and 2020.

The analysis reveals a sharp drop in the concentration of five of the six pollutants in 2020 during the lockdown period in India. Other than Ozone all the pollutants exhibited a decline in their concentration as compared to a week before the lockdown. Higher concentrations can be observed in the period between March 18 and March 25 in 2020. These concentrations drop sharply in the period beginning from March 25' 2020. Particulate Matter pollution declined by one-third in the case of PM 2.5 while in case of PM10 the decline has been fifty percent. Nitrogen Dioxide (NO_2) concentration declined about two-thirds in the same period. A major source of this pollutant is vehicular exhaust. Sulphur Dioxide (SO_2) emissions declined by thirty percent while the concentration of Carbon Monoxide (CO) emissions remained stable during the period. Ozone (O_3) concentration increased in the regular trend but remained significantly below earlier years' values.

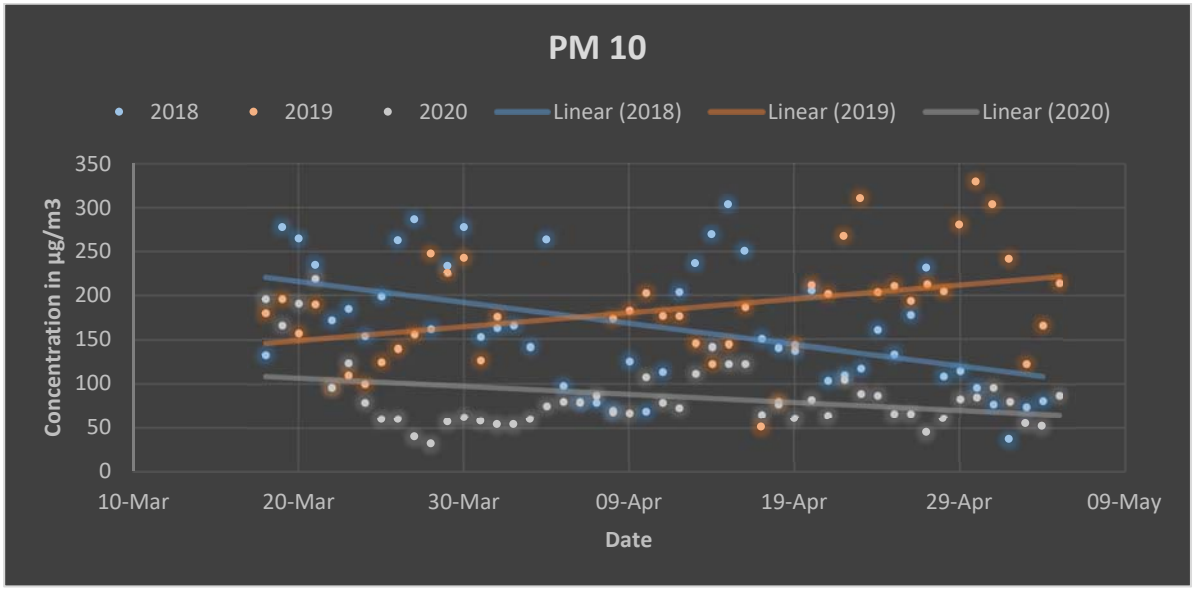
Average PM 2.5 values in 2018 and 2019 were 165 μg/m³ and 150 μg/m³ respectively for the comparison period while the same remained at 109 μg/m³ in 2020. Average value of PM10 concentration declined to 75μg/m³ as compared with 165 μg/m³. PM10 values met National Ambient Air Quality (NAAQ) standards (Central Pollution Control Board, 2009) for thirty-eight of the forty-nine days and were never more than twice the safe limit during the lockdown period (Figure 1 and Figure 2).

Figure 1 Concentration of PM 2.5 at National Institute of Malaria Research (NIMR) in Delhi



Source: The World Air Quality Project, 2020

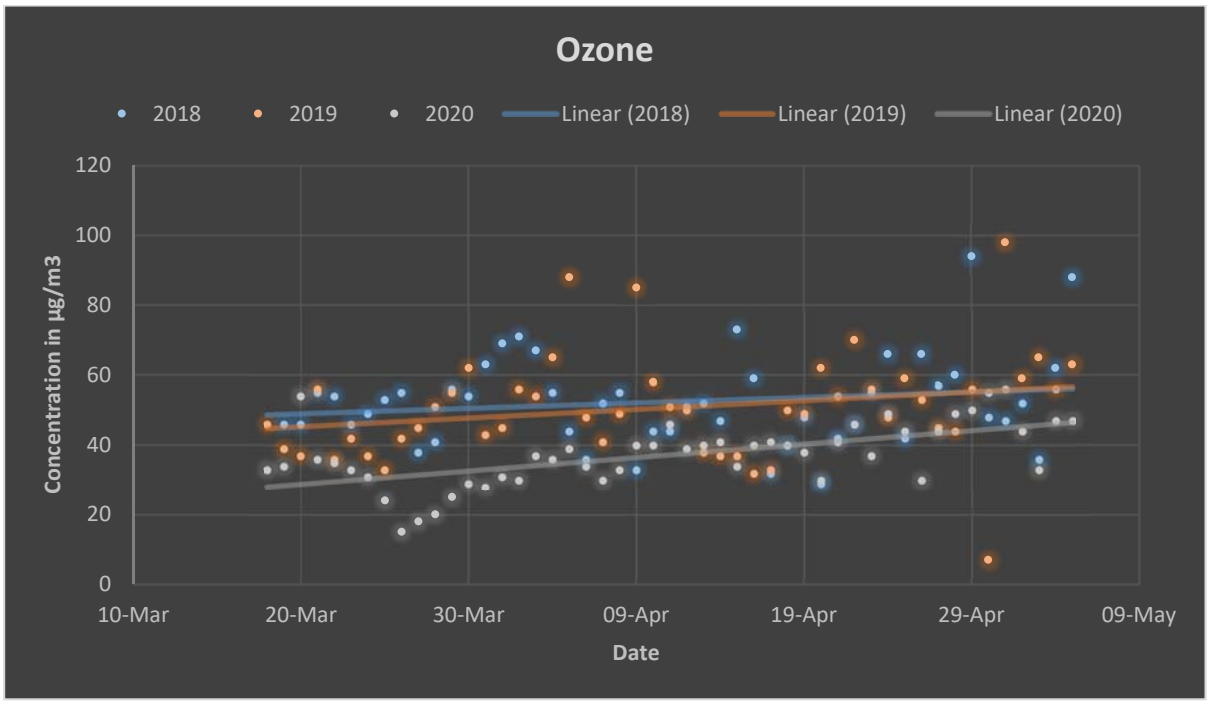
Figure 2 PM10 Concentration at NIMR, Sector-8 Dwarka, Delhi



Source: The World Air Quality Project, 2020

The value of Ozone (O3) pollution increased from March 2020 to May 2020 in accordance with the regular trends, as ground-level Ozone concentrations are linked to summer heat. But the decline in Ozone concentration is perceptible as the concentration dropped to an average of 37 μg/m^3 compared with 53 μg/m^3 and 52 μg/m^3 for 2018 and 2019 respectively. These concentrations were always below the safe standard of 100 μg/m^3 (Figure 3).

Figure 3 Ozone Concentration Levels at NIMR, Sector-8 Dwarka, Delhi



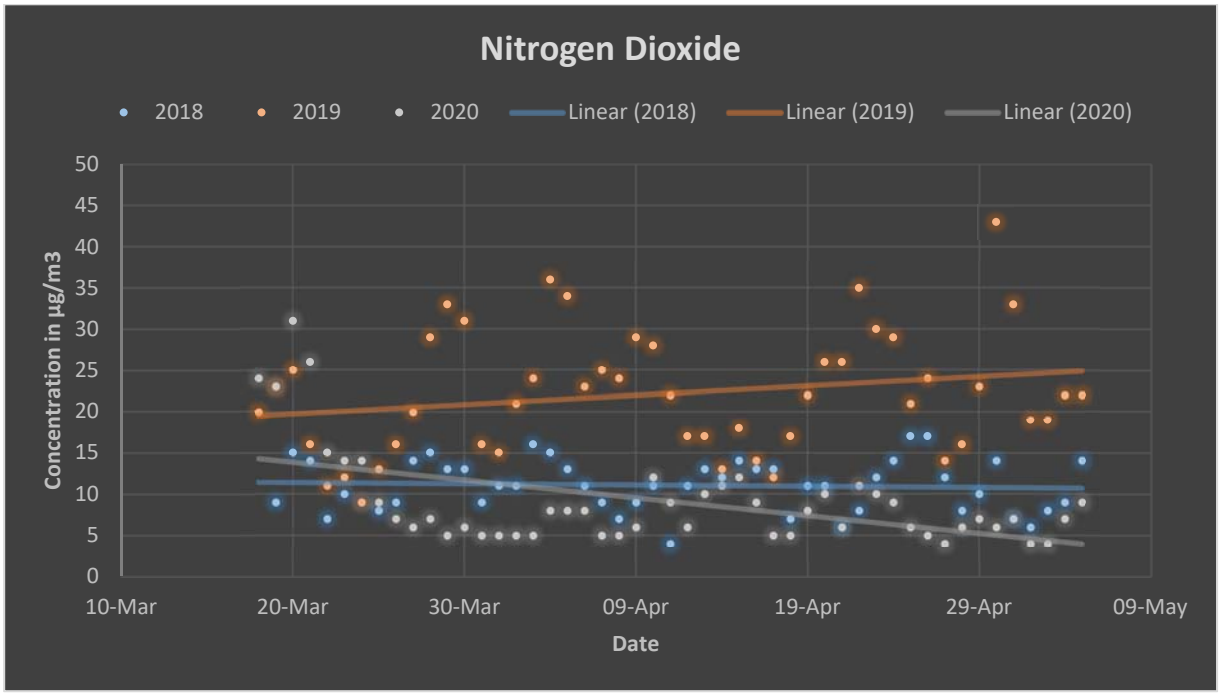
Source: The World Air Quality Project, 2020

Major human activity leading to the generation of Nitrogen Dioxide (NO_2) is the burning of fossil fuels. This includes exhaust from vehicular emissions and industries. Such activity subsided suddenly in the national capital territory of Delhi beginning 25 March 2020. This resulted in a plummeting of Nitrogen Dioxide level as depicted in Figure 4. The Nitrogen Dioxide concentrations declined from a peak of 31 μg/m^3 on 20 March 2020 to 9 μg/m^3 on 25 March 2020 and reached a bottom of 4 μg/m^3 on 27 April 2020. The average concentration during the 7 weeks remained at 7 μg/m^3 in 2020 compared to 23 μg/m^3 and 11 μg/m^3 during the same period in 2019 and 2018 respectively. This represents a sixty-six percent decline compared to the previous year. Only essential transportation and industrial services were maintained during this period.

Sulphur Dioxide (SO_2) pollution also declined in 2020 compared to 2019 but remained above 2018 pollution levels (Figure 5). Major sources of this pollutant are thermal power plants, trains, diesel-fuelled equipment and sometimes preservatives in fruit and vegetable storages. Average

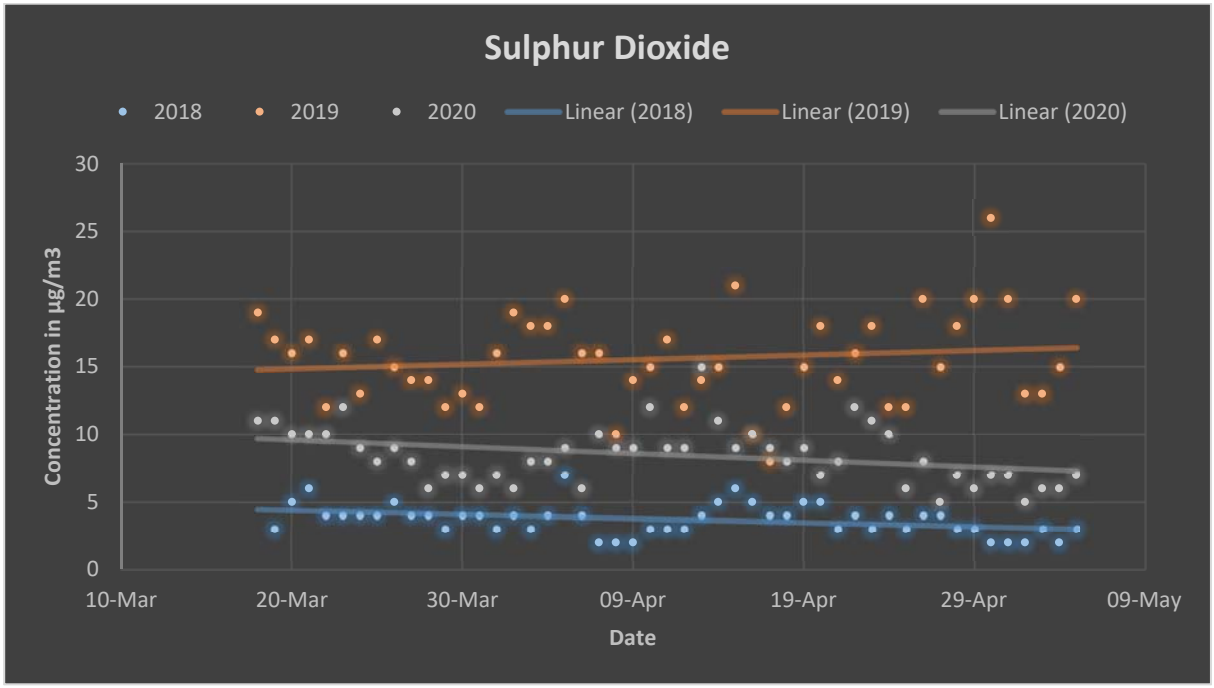
values of concentration remained at 4 μg/m³, 16 μg/m³ and 8 μg/m³ for the year 2018, 2019 and 2020 respectively.

Figure 4 Nitrogen Dioxide Concentration at Sector-8 Dwarka, Delhi



Source: The World Air Quality Project, 2020

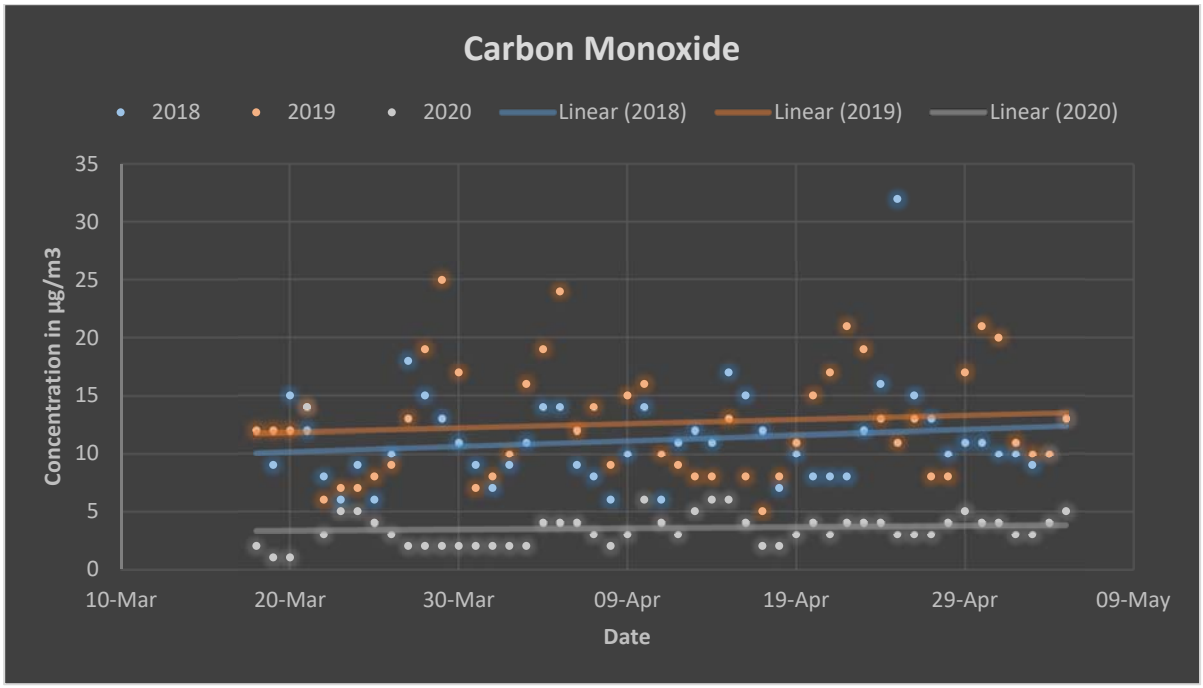
Figure 5 Sulphur Dioxide Concentration at NIMR, Dwarka, Delhi



Source: The World Air Quality Project, 2020

Average value of Carbon Monoxide (CO) concentration declined to 4 μg/m^3 compared to 11 μg/m^3 in 2018 and 13 μg/m^3 in 2019. It is generated by the incomplete combustion of fossil fuels and is part of vehicle emissions. The concentrations of this pollutant have remained consistently low during the entire study period (Figure 6).

Figure 6 Carbon Monoxide Concentration at Sector-8 Dwarka, Delhi



Source: The World Air Quality Project, 2020

The decline in pollution levels during the lockdown period has been comprehensive and has proven the role of transport and industrial sector in urban air pollution. Since, the study utilizes data from the residential quarter of the city the primary contributor to the data is vehicular emissions and thus, signify the major role of vehicular exhausts in urban air pollution. This calls for policies and strategies to tackle this pollution source. A shift of transport to public and non-motorised modes shall be the focus for the future bringing about cleaner air in the cities. Industries should also implement schemes to catch and suppress pollution at source.

Detailed data tables for pollutant concentrations at National Institute of Malaria Research, Sector-8 Dwarka, Delhi have been provided in the annexures.

References

Central Pollution Control Board (2009) *National Ambient Air Quality Standards*. India: The Gazette of India. Available at: https://cpcb.nic.in/uploads/National_Ambient_Air_Quality_Standards.pdf.

The World Air Quality Project (2020) *Delhi Air Pollution Historical Data*, *aqicn.org*. Available at: https://aqicn.org/city/delhi/punjabi-bagh/ (Accessed: 5 May 2020).

Annexures

Location		NIMR, Sec-8, Dwarka, Delhi		
Pollutant (Benchmark)		**PM 2.5 (60 µg/m^3)**		
S.No.	**Date/Year**	**2018**	**2019**	**2020**
1	**18-Mar**	241	172	166
2	**19-Mar**		175	168
3	**20-Mar**	139	168	171
4	**21-Mar**	203	148	170
5	**22-Mar**	211	192	164
6	**23-Mar**	220	101	153
7	**24-Mar**	165	141	136
8	**25-Mar**	186	135	128
9	**26-Mar**	171	151	108
10	**27-Mar**	199	160	108
11	**28-Mar**	180	145	79
12	**29-Mar**	166	164	65
13	**30-Mar**	144	169	91
14	**31-Mar**	178	172	107
15	**01-Apr**	186	124	99
16	**02-Apr**	154	135	91
17	**03-Apr**	165	153	86
18	**04-Apr**	169	166	97
19	**05-Apr**	170	170	122
20	**06-Apr**	298	201	136
21	**07-Apr**	151	156	123
22	**08-Apr**	117	198	109
23	**09-Apr**	130	137	103
24	**10-Apr**	123	151	108
25	**11-Apr**	169	160	155
26	**12-Apr**	133	149	119

27	**13-Apr**	136	134	112
28	**14-Apr**	151	127	146
29	**15-Apr**	185	126	149
30	**16-Apr**	205	118	134
31	**17-Apr**	182	109	137
32	**18-Apr**	169	52	76
33	**19-Apr**	135	98	76
34	**20-Apr**	165	157	93
35	**21-Apr**	161	174	108
36	**22-Apr**	161	152	96
37	**23-Apr**	155	172	143
38	**24-Apr**	136	174	119
39	**25-Apr**	172	150	134
40	**26-Apr**	185	156	74
41	**27-Apr**	230	157	94
42	**28-Apr**	209	147	78
43	**29-Apr**	209	148	99
44	**30-Apr**	166	164	134
45	**01-May**	159	173	136
46	**02-May**	133	175	143
47	**03-May**	130	150	97
48	**04-May**	107	122	86
49	**05-May**	115	160	78
	TOTAL	6945	6291	4576
	Period Average	165	150	109

Location		NIMR, Sec-8, Dwarka, Delhi		
Pollutant (Benchmark)		**PM 10 (100 µg/m^3)**		
S.No.	**Date/Year**	**2018**	**2019**	**2020**
1	**18-Mar**		180	196
2	**19-Mar**	133	196	166
3	**20-Mar**	278	157	191
4	**21-Mar**	265	190	219
5	**22-Mar**	235	96	96
6	**23-Mar**	172	110	124
7	**24-Mar**	185	100	79
8	**25-Mar**	154	125	60
9	**26-Mar**	199	140	60
10	**27-Mar**	263	156	40
11	**28-Mar**	287	248	32
12	**29-Mar**	162	226	57
13	**30-Mar**	234	243	62
14	**31-Mar**	278	127	58

15	**01-Apr**	153	176	54
16	**02-Apr**	163		54
17	**03-Apr**	166		60
18	**04-Apr**	142		75
19	**05-Apr**	264		80
20	**06-Apr**	98		79
21	**07-Apr**	80		87
22	**08-Apr**	79	174	68
23	**09-Apr**	70	183	67
24	**10-Apr**	126	203	108
25	**11-Apr**	69	177	79
26	**12-Apr**	114	177	73
27	**13-Apr**	204	146	112
28	**14-Apr**	237	123	142
29	**15-Apr**	270	145	123
30	**16-Apr**	304	187	123
31	**17-Apr**	251	51	65
32	**18-Apr**	151	80	77
33	**19-Apr**	141	144	61
34	**20-Apr**	138	212	82
35	**21-Apr**	206	202	64
36	**22-Apr**	104	268	105
37	**23-Apr**	110	311	89
38	**24-Apr**	118	204	87
39	**25-Apr**	161	211	66
40	**26-Apr**	134	194	66
41	**27-Apr**	178	213	45
42	**28-Apr**	232	205	61
43	**29-Apr**	109	281	83
44	**30-Apr**	115	330	85
45	**01-May**	96	304	96
46	**02-May**	77	242	80
47	**03-May**	37	123	55
48	**04-May**	74	166	52
49	**05-May**	81	214	87
	TOTAL	6629	6911	3159
	Period Average	158	165	75

Location		NIMR, Sec-8, Dwarka, Delhi		
Pollutant (Benchmark)		**O_3 (100 µg/m^3)**		
S. No.	**Date/Year**	**2018**	**2019**	**2020**
1	**18-Mar**		46	33
2	**19-Mar**	46	39	34

3	**20-Mar**	46	37	54
4	**21-Mar**	55	56	36
5	**22-Mar**	54	36	35
6	**23-Mar**	46	42	33
7	**24-Mar**	49	37	31
8	**25-Mar**	53	33	24
9	**26-Mar**	55	42	15
10	**27-Mar**	38	45	18
11	**28-Mar**	41	51	20
12	**29-Mar**	56	55	25
13	**30-Mar**	54	62	29
14	**31-Mar**	63	43	28
15	**01-Apr**	69	45	31
16	**02-Apr**	71	56	30
17	**03-Apr**	67	54	37
18	**04-Apr**	55	65	36
19	**05-Apr**	44	88	39
20	**06-Apr**	36	48	34
21	**07-Apr**	52	41	30
22	**08-Apr**	55	49	33
23	**09-Apr**	33	85	40
24	**10-Apr**	44	58	40
25	**11-Apr**	44	51	46
26	**12-Apr**	51	50	39
27	**13-Apr**	52	38	40
28	**14-Apr**	47	37	41
29	**15-Apr**	73	37	34
30	**16-Apr**	59	32	40
31	**17-Apr**	32	33	41
32	**18-Apr**	40	50	40
33	**19-Apr**	48	49	38
34	**20-Apr**	29	62	30
35	**21-Apr**	42	54	41
36	**22-Apr**	46	70	46
37	**23-Apr**	55	56	37
38	**24-Apr**	66	48	49
39	**25-Apr**	42	59	44
40	**26-Apr**	66	53	30
41	**27-Apr**	57	45	44
42	**28-Apr**	60	44	49
43	**29-Apr**	94	56	50
44	**30-Apr**	48	7	55
45	**01-May**	47	98	56
46	**02-May**	52	59	44

47	**03-May**	36	65	33
48	**04-May**	62	56	47
49	**05-May**	88	63	47
	TOTAL	2222	2192	1570
	Period Average	53	52	37

Location		NIMR, Sec-8, Dwarka, Delhi		
Pollutant (Benchmark)		**NO_2 (80 µg/m^3)**		
S. No.	**Date/Year**	**2018**	**2019**	**2020**
1	**18-Mar**		20	24
2	**19-Mar**	9	23	23
3	**20-Mar**	15	25	31
4	**21-Mar**	14	16	26
5	**22-Mar**	7	11	15
6	**23-Mar**	10	12	14
7	**24-Mar**	9	9	14
8	**25-Mar**	8	13	9
9	**26-Mar**	9	16	7
10	**27-Mar**	14	20	6
11	**28-Mar**	15	29	7
12	**29-Mar**	13	33	5
13	**30-Mar**	13	31	6
14	**31-Mar**	9	16	5
15	**01-Apr**	11	15	5
16	**02-Apr**	11	21	5
17	**03-Apr**	16	24	5
18	**04-Apr**	15	36	8
19	**05-Apr**	13	34	8
20	**06-Apr**	11	23	8
21	**07-Apr**	9	25	5
22	**08-Apr**	7	24	5
23	**09-Apr**	9	29	6
24	**10-Apr**	11	28	12
25	**11-Apr**	4	22	9
26	**12-Apr**	11	17	6
27	**13-Apr**	13	17	10
28	**14-Apr**	12	13	11
29	**15-Apr**	14	18	12
30	**16-Apr**	13	14	9
31	**17-Apr**	13	12	5
32	**18-Apr**	7	17	5
33	**19-Apr**	11	22	8
34	**20-Apr**	11	26	10

35	**21-Apr**	6	26	6
36	**22-Apr**	8	35	11
37	**23-Apr**	12	30	10
38	**24-Apr**	14	29	9
39	**25-Apr**	17	21	6
40	**26-Apr**	17	24	5
41	**27-Apr**	12	14	4
42	**28-Apr**	8	16	6
43	**29-Apr**	10	23	7
44	**30-Apr**	14	43	6
45	**01-May**	7	33	7
46	**02-May**	6	19	4
47	**03-May**	8	19	4
48	**04-May**	9	22	7
49	**05-May**	14	22	9
	TOTAL	465	971	298
	Period Average	11	23	7

Location		NIMR, Sec-8, Dwarka, Delhi		
Pollutant (Benchmark)		**SO_2 (80 µg/m^3)**		
S. No.	**Date/Year**	**2018**	**2019**	**2020**
1	**18-Mar**		19	11
2	**19-Mar**	3	17	11
3	**20-Mar**	5	16	10
4	**21-Mar**	6	17	10
5	**22-Mar**	4	12	10
6	**23-Mar**	4	16	12
7	**24-Mar**	4	13	9
8	**25-Mar**	4	17	8
9	**26-Mar**	5	15	9
10	**27-Mar**	4	14	8
11	**28-Mar**	4	14	6
12	**29-Mar**	3	12	7
13	**30-Mar**	4	13	7
14	**31-Mar**	4	12	6
15	**01-Apr**	3	16	7
16	**02-Apr**	4	19	6
17	**03-Apr**	3	18	8
18	**04-Apr**	4	18	8
19	**05-Apr**	7	20	9
20	**06-Apr**	4	16	6
21	**07-Apr**	2	16	10
22	**08-Apr**	2	10	9

23	**09-Apr**	2	14	9
24	**10-Apr**	3	15	12
25	**11-Apr**	3	17	9
26	**12-Apr**	3	12	9
27	**13-Apr**	4	14	15
28	**14-Apr**	5	15	11
29	**15-Apr**	6	21	9
30	**16-Apr**	5	10	10
31	**17-Apr**	4	8	9
32	**18-Apr**	4	12	8
33	**19-Apr**	5	15	9
34	**20-Apr**	5	18	7
35	**21-Apr**	3	14	8
36	**22-Apr**	4	16	12
37	**23-Apr**	3	18	11
38	**24-Apr**	4	12	10
39	**25-Apr**	3	12	6
40	**26-Apr**	4	20	8
41	**27-Apr**	4	15	5
42	**28-Apr**	3	18	7
43	**29-Apr**	3	20	6
44	**30-Apr**	2	26	7
45	**01-May**	2	20	7
46	**02-May**	2	13	5
47	**03-May**	3	13	6
48	**04-May**	2	15	6
49	**05-May**	3	20	7
	TOTAL	151	653	342
	Period Average	4	16	8

Location		NIMR, Sec-8, Dwarka, Delhi		
Pollutant (Benchmark)		**CO (4 µg/m^3)**		
S. No.	**Date/Year**	**2018**	**2019**	**2020**
1	**18-Mar**		12	2
2	**19-Mar**	9	12	1
3	**20-Mar**	15	12	1
4	**21-Mar**	12	14	14
5	**22-Mar**	8	6	3
6	**23-Mar**	6	7	5
7	**24-Mar**	9	7	5
8	**25-Mar**	6	8	4
9	**26-Mar**	10	9	3
10	**27-Mar**	18	13	2

11	**28-Mar**	15	19	2
12	**29-Mar**	13	25	2
13	**30-Mar**	11	17	2
14	**31-Mar**	9	7	2
15	**01-Apr**	7	8	2
16	**02-Apr**	9	10	2
17	**03-Apr**	11	16	2
18	**04-Apr**	14	19	4
19	**05-Apr**	14	24	4
20	**06-Apr**	9	12	4
21	**07-Apr**	8	14	3
22	**08-Apr**	6	9	2
23	**09-Apr**	10	15	3
24	**10-Apr**	14	16	6
25	**11-Apr**	6	10	4
26	**12-Apr**	11	9	3
27	**13-Apr**	12	8	5
28	**14-Apr**	11	8	6
29	**15-Apr**	17	13	6
30	**16-Apr**	15	8	4
31	**17-Apr**	12	5	2
32	**18-Apr**	7	8	2
33	**19-Apr**	10	11	3
34	**20-Apr**	8	15	4
35	**21-Apr**	8	17	3
36	**22-Apr**	8	21	4
37	**23-Apr**	12	19	4
38	**24-Apr**	16	13	4
39	**25-Apr**	32	11	3
40	**26-Apr**	15	13	3
41	**27-Apr**	13	8	3
42	**28-Apr**	10	8	4
43	**29-Apr**	11	17	5
44	**30-Apr**	11	21	4
45	**01-May**	10	20	4
46	**02-May**	10	11	3
47	**03-May**	9	10	3
48	**04-May**	10	10	4
49	**05-May**	13	13	5
		540	618	175
		11	13	4